THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

VOL. II.—No. 3. NEW YORK, SEPTEMBER 15, 1883. $2 PER ANNUM. 5 CENTS A COPY.

The Electric Light in Theatres.

The splendor of the electric light, the readiness with which it can be adapted to the production of spectacular effects, and the hygienic qualities which it possesses, suggested its application to lighting theatres at an early date. On the other hand, the dangers of fire from gas also invited the attention of managers and proprietors of theatres to the subject, and led them to consider the merits and advantages of this mode of illumination. Even as early as 1879, when the electric arc lamp of to-day was still in the hands of the inventor, and the incandescent lamp was yet a thing of the future; when, in a word, the Jablochkoff candle occupied almost alone the vast field of electric lighting in Europe, the introduction of the electric light into theatres was attempted. The Châtelet theatre in Paris was fitted with an installation of Jablochkoff candles, which still remains in use in substantially the same form.

The theatre of Bellecour, at Lyons, France, was also similarly fitted later in the same year. In this installation the use of the Jablochkoff candle for scenic effects was attempted for the first time, for twelve of the fifty-two candles used were placed on the stage. Of the rest, eight were in the main chandelier, four in the auditorium, and the others in the foyer, vestibule, passageways, etc. These lamps were fed by three Siemens alternate current machines, situated in the basement. The illumination was found extremely satisfactory on all sides, and the installation proved a success.

Since that time the rapid multiplication of electric arc lighting systems, and the improvements which they presented, the advent of the incandescent lamp, which is so much better adapted to this species of illumination, have awakened a more general interest in the subject on the part of electrical engineers as well as on the part of those in charge of theatres. Besides the peculiar merits which render the electric light desirable from the hygienic point of view there is another which proves equally important. The carbonic acid gases, and the vapors given off by the burning gas in such places, not only produce a bad effect on the audience, necessitating thorough ventilation, but also on the colors used in the paintings and ornaments of the theatre. In 1879 M. Garnier director of the Grand Opera in Paris, sent a report to the Minister of Public Works in which he called attention to the fact that the beautiful paintings by Baudry in the foyer were discolored and smirched by the sooty vapors of the gas, which had to be used very freely in order to afford the complete illumination desirable to show the beauties of this grand place to advantage. This led to experiments with various systems of electric lighting during the years 1880 and 1881. In the first trials the Jablochkoff candles, the Lontin arc lamps and the Werdermann semi-incandescent lamps were used. In the second series of experiments a fair representation of the American systems was included, for we find the Brush arc lamps and the Maxim and the Edison incandescent lamps used quite freely. This was the first theatrical installation comprising incandescent lamps, and it proved such a success as to invite the attention of other theatrical men to the capabilities of these lamps. Soon afterward the Savoy Theatre in London was fitted up with an installation in which only incandescent lamps, of the Swan type, were used

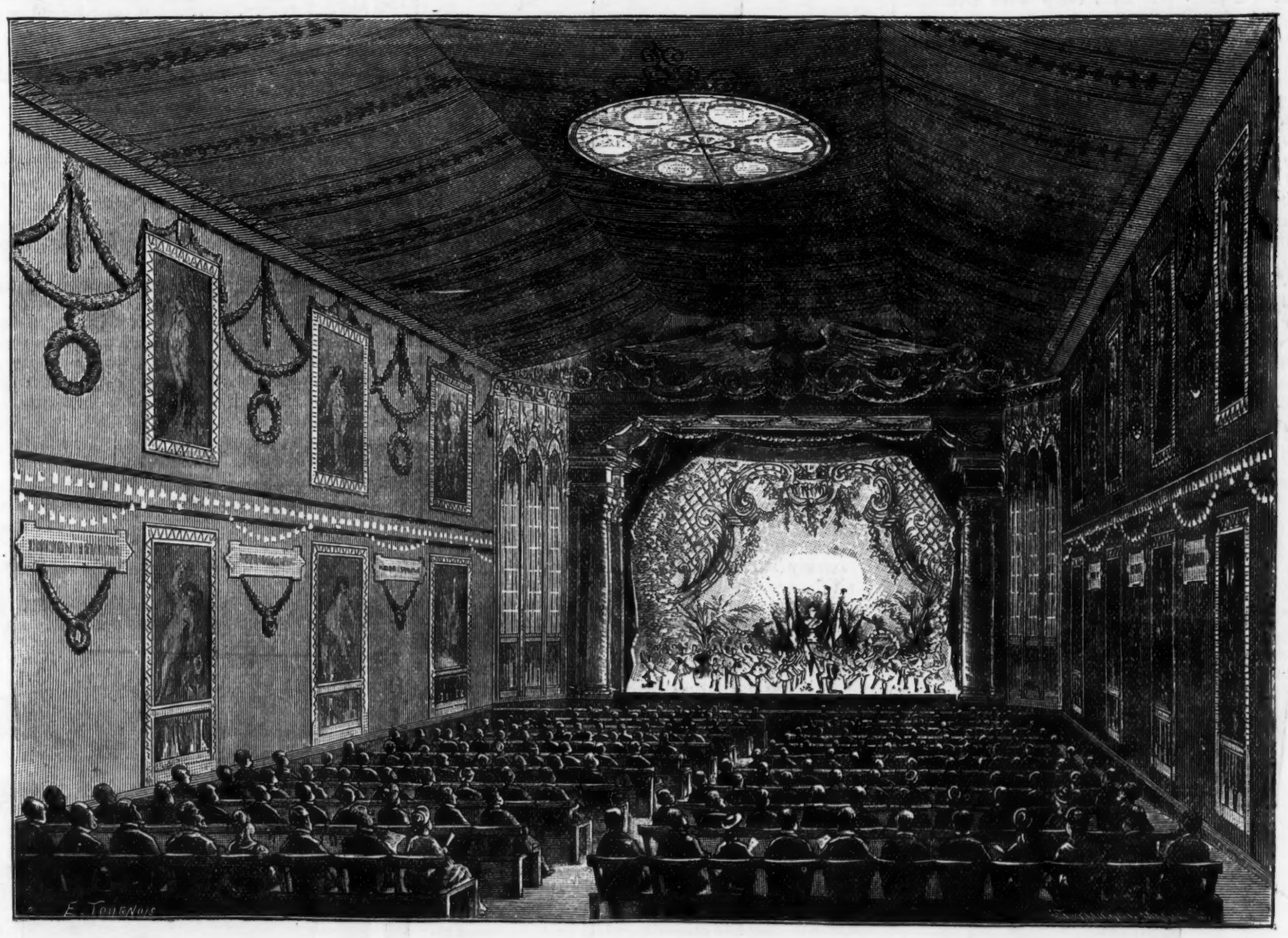

FIG. 1—INTERIOR OF A THEATRE LIGHTED BY ELECTRICITY.

to the number of 1,158, of which 824 were disposed on the stage. The light could be graduated for producing scenic effects at will by introducing resistance in the circuits, by means of suitable rheostats specially provided.

Since that time the attempts to adapt the electric light to theatres have been numerous in all parts of Europe, and they have also been made to some extent in America. So important is this branch of electric light engineering considered in Europe by electricians and the theatrical public generally that at all three of the electrical expositions—that at Paris, that at Munich and that at Vienna—just opened, it has been made the subject of special exhibits. At the Munich Exposition a part of the Crystal Palace had been partitioned off into an improvised theatre, with an auditorium large enough to contain 600 spectators besides the orchestra. The manager of the Royal Theatre at Munich, Herr von Perfall, had kindly furnished the scenery, ornaments, decorations and all other materials

necessary for the purpose, and placed the work of construction under the immediate charge of the chief machinist of the Royal Theatre, Herr Lautenschlager.

In a recent number of *La Lumière Electrique* we find an illustrated description of this miniature theatre, by M. Aug. Guerout, from which we are enabled to procure some interesting details and illustrations that will enable our readers to form an idea of the nature of this class of electric lighting installations. Our front-page illustration represents the interior of the theatre. The auditorium was lighted in part by a cluster of six Schuckert arc lamps, placed above the ceiling so that their light could be pro-

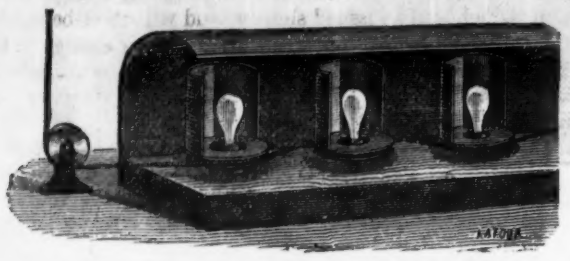

FIG. 2.

jected down over the audience through a circular panel of glass, ground in ornamental designs. This method of lighting was as effective in the magnificent richness of the illumination it produced as it was ingenious in disposing the lamps out of sight. Arc lamps are not at best well suited to ornamental purposes; on the contrary, they often detract from the appearance of an ornamented interior. In this way all suggestions of cumbrous appliances were effectually removed, while the brilliant rosette which the lighted panel made was of itself highly ornamental. The light could be varied in intensity for scenic effects by cutting out some of the lamps and substituting equivalent resistances. Besides this light there were numerous incandescent lamps on the walls, arranged in artistic lines and curves, the profuse light from all of which blended admirably well with the light of the arc lamps above the ceiling.

The stage was illuminated entirely by the Edison lamp, disposed in various places. These lamps were arranged in such a manner that the light given off could be instantly changed from its natural color to red or blue, for the production of spectacular effects.

In the footlights each lamp was surrounded at its base by a horizontal pulley (Fig. 2), which could be rotated by pulling a rope passing alternately in front of one lamp and behind the other, as shown in the figure. This pulley was provided with a vertical wire screen of cylindrical form, and extending over two-thirds of its margin. One-half of this screen was covered with a film of red gelatine and the other half with a film of blue gelatine. Thus, on turning the pulley around once, the light remained yellow for one-third of the revolution, and blue or red for one-third each

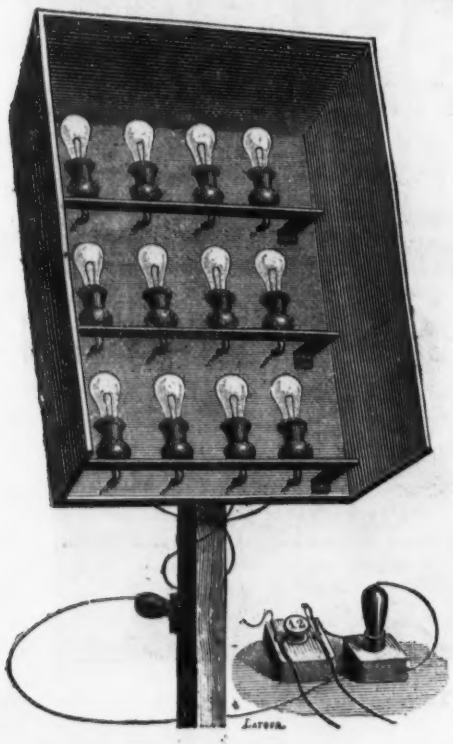

FIG. 5.

also. Care was taken to dispose the screens in such a manner that all the lamps might be of the same color, and change simultaneously to another given color whenever the pulleys were rotated by pulling the rope.

In the flies the lamps were disposed in rows between the scenes, the lamps and shade being inverted (Fig. 3). The guide-rope by which the screens were rotated also worked differently. It was in sections, each passing from one pulley to the next, as will be readily understood from the figure. In the lights placed at the ends and between the scenes in vertical rows, the screens were not placed on discs, but moved up and down on two vertical guide-rods (Fig. 4). In this case the upper half of the gelatine film covering the screens was blue and the lower half red, so that by pulling the rope either way the colors were changed simultaneously from yellow to red or blue.

In every case the usual position of the screens was such that the light was of yellow or natural glow, and by a slight pull of a rope the color of the light on the whole stage could be changed instantly to red or blue.

Besides these were special groups of lamps for throwing the light upon certain parts in greater volume, as for instance on the background scene. The arrangement (Fig. 5) consisted of a sort of inclined box, supported on a vertical stand. This box, whose interior formed a reflective surface, contained three rows of four Edison lamps, suitably mounted. In addition to these, there were also three arc light projectors for throwing intense beams of light in any desired direction.

Fig. 7 represents the stage in side elevation, and shows how the apparatus was disposed. The light of the incandescent lamps could be regulated at pleasure from a switch table, shown in the figures, and by means of which resistance coils contained in a box below the stage, could be included into the circuits. Fig. 6 is a perspective view of this switch table, in which is shown a series of handles, each of which corresponds to a special circuit or branch of circuit, each handle being designated by inscriptions. By moving any handle a resistance is gradually introduced into the corresponding circuit. The ends of all the handles rest against a horizontal bar, which can be pulled forward so as to move all the handles at once. The motion may be done by hand quickly, or it may be done gradually by turning the small wheel shown in the figure.

During the Munich Exposition, there were ballet per-

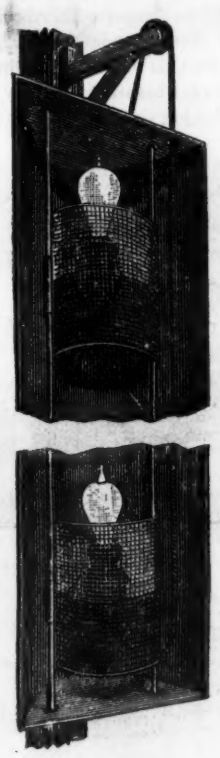

FIG. 4.

formances at this theatre every evening, and on the 26th of September (1882), after numerous experiments, the congress of theatre managers gave a formal opinion highly favorable to the lighting of halls and theatres by the electric light, specially in regard to the immunity from dangers of fire.

The official report of the Munich Exposition also commends the electric light for this purpose in terms of high praise. It dwells on the safety from fire and on the innumerable other advantages which it possesses. The lamps give off but little heat and no noxious and incommoding vapors. They can be placed any where without danger to the decorations, which they bring into relief much more efficiently, because their light has a more sunlike tone than gas and is absolutely steady.

They can be lighted and regulated at will by a single attendant, and, in combining the arc with the incandescent light, effects can be obtained which are impossible with gas. The lamps may be lowered to complete obscurity, while gaslights must always be left partially lighted to obviate relighting. Thus the electric light on the stage may be made to pass by imperceptible gradations from the obscurity of the stormy night to the glare of the midsummer sun. These advantages, which were so well shown at the theatre of the Munich exposition, have since been displayed to greater advantage still in real installations, and the progress of the electric light in this direction is all the more remarkable and encouraging when the obstacles which it has to contend with are considered. All theatres and public halls are provided with superb and costly gas fixtures, and the managers naturally shrink from the expense of a change to the electric light. Besides in many cases there is no available space in which the apparatus necessary for generating the electricity can be placed. Therefore, when the public expresses the want and the demand for more light and better light, the assistance of gas is invoked anew. But the demand cannot be supplied by means of gas, for increased gas means increased danger from fire, and increased contamination of the atmosphere, and in fact an increase in all the disadvantages characteristic of gas. The electric light therefore becomes a necessity. It must be procured at any cost. In what concerns the amusement of the public, the question of cost and economy becomes in a measure secondary to that of excellence and merit, and especially so is it in the case of theatres. This gives the vantage ground to the electric light. The list of new installations is an ample proof of this. During the present year the electric light has found its way into a large number of the

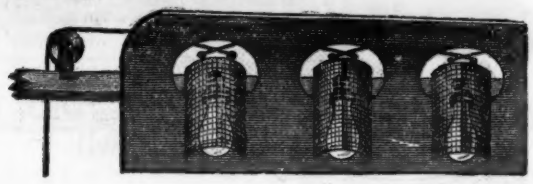

FIG. 3.

most celebrated theatres of the world. The Eden-Théâtre of Paris, the royal theatres of Madrid, Berlin, Edinburgh, the national theatre of Budapest, the Dresden theatre, the Prague theatre, one of the largest installations, comprising 1,700 Edison lights; the Manzoni theatre of Milan, the Grand Opera of Vienna, are among the most important European theatres which have been provided with the electric light. In this country the electric light has also been making its way successfully into theatres, and we may mention Wallack's theatre, the Madison Square theatre and Niblo's Garden, all of New York, as recent additions to the already long list of theatres and public halls lighted by electricity. The theatre, in a word, is a sphere of application which the electric light can call its own, because it is specially and eminently adapted to it, and taking these installations as an indication of the rate of progress, we believe that it will not be long before it will take definite possession of the field and distance competition.

Underground Wires in Chicago.

Among the German guests of the Villard party who stopped in Chicago during last week there was great wonderment at the prevalence of the telegraph-pole nuisance. Consul Kreissmann, who has resided in Berlin for a long time, was especially strong in the expression of displeasure at the presence of the wire-net in the air, surrounding and keeping from view nearly every architectural feature to be met with in the heart of the city.

"Now, look here," he said to a reporter, "we have in Berlin some hundred or more telegraph stations; we have about 200 fire-alarm stations, and have more than 2,000 telephones, the number increasing daily, still we do not see a single wire strung on poles in the entire city. I have used the telephone here, and have found that I heard a good deal of talk I was not entitled to. I am told that was on account of the crossing of the lines, but I must confess in Berlin I have never been subjected to such trouble. Our telephones, although all the wires are underground there, work to a charm, and we can carry on a conversation for a distance of from ten to fifteen miles without the disturbances I have experienced here on very much shorter circuits."

With these remarks in his mind, a reporter asked yesterday Mr. E. S. Dreyer, of the Chicago Underground Electric

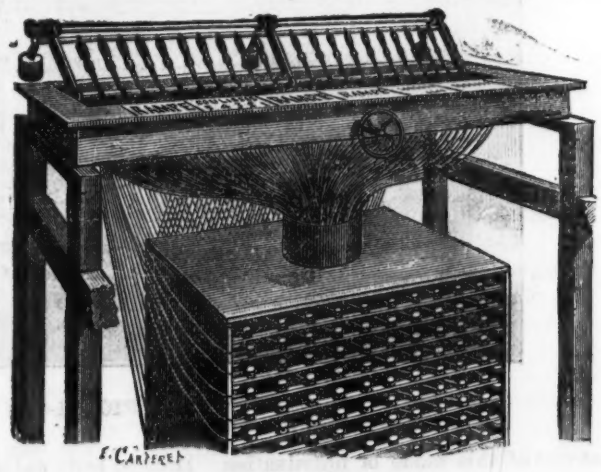

FIG. 6.

Conduit Company: "Why don't you hurry up your conduit and put the wires under ground?"

"We are doing all we can," was the answer, "but why should we lay conduits before we have electric lines to put into them? The old companies seem to be still hoping for short-pole ordinances, and it would be folly for us to construct conduits for them without being sure of their being used. We are negotiating with a number of parties about the use of our conduit, which under our franchise we can lay in any street of the city, but we really don't feel like saying much of our future plans as long as it is possible for any one to talk about the continuance of the pole nuisance in this city, as has been done lately."

"Now, see here," said Mr. Fuller, the Managing Director of the Underground Conduit Company, who had listened, "you look on the dark side always, and for that reason forget what we are doing. We have closed only to-day a contract for laying a large number of single wires from the heart of the city to the Stock Yards, and I am going East to-night to order the wire for that purpose. You may put it down as a fact that underground telegraphy is no longer an experiment but an accomplished fact, for I had a letter only to-day from Mr. Stewart, the Superintendent of the Baltimore & Ohio Telegraph Company, telling me that he had satisfied himself of the perfect practicability of our system, and that he would make arrangements to take care of his Chicago wires with us as soon as he could come on here. You see a practical telegrapher does not require a long time to see how much better a wire is off lying properly insulated at perfect rest in an underground conduit than it possibly could be strung up on poles, subject to atmospheric and other influences. When a wire is once down in our conduits that is the last of it as far as taking care of it is concerned, as it always there when wanted."

"Granted all the advantages of your system, Mr. Fuller, what are your plans for the future?"

"We shall extend our conduit to cover the whole city as fast as the demand justifies it. I expect to close negotiations with an electric light company within a week or two, which will enable and justify us in laying conduits throughout the business portion of the city. What we have done heretofore should satisfy everybody that we do not destroy pavements, for no one can tell where we have torn them up. Still we prefer to lay our conduits before streets are permanently paved, and shall probably be in State street before the new pavement is down. To accommodate the telephones, which, according to Prof. Gray, can be run in underground conduits better for twenty-five miles than on poles for one-fifth the distance, we want to lay conduits in every second north and south and east and west street as soon as possible, keeping, as far as possible, step with the improvements now going on. We can also utilize the acres under the sidewalks without discommoding any one or interfering with the streets except at the crossings, our conduits taking up no space to speak of. As far as the working of the conduit is concerned, the experience of the Postal Telegraph Company should be sufficient, whose wires are in cables in our conduits, and are doing all that is asked. We are getting improved cables and single wires, and are able to put every wire in Chicago underground and afford better facilities to supervise them than the pole system offers. Our conduit offers an easy access to every wire, and allows of connections being made without any disturbance of the pavement, and if the Western Union will furnish the wire we will bring their line from the city limits to their office within a week, together with all the telephone wires, on the line of our conduit, guaranteeing a satisfactory working of every wire laid."—*Chicago Tribune.*

An Important Manufacturing Change in Baltimore.

The well-known firm of Davis & Watts, Baltimore, Md., manufacturers of telephone, telegraph and electrical apparatus and supplies, has been dissolved. Mr. A. G. Davis, the senior member, bought out the entire interest of Mr. J. H. C. Watts, and has consolidated the business of the late firm of Davis & Watts with that of the extensive Viaduct Manufacturing Company, of which he is the president and principal owner. Mr. Watts retires with a handsome competency in hard cash, and has also, we understand, been recently married, or is about to be married, to a Baltimore lady of great wealth. Mr. and Mrs. Watts will shortly leave for an extended tour through Europe.

Mr. Davis is well known to most readers of THE ELECTRICAL WORLD, and especially to those connected with the telephone business. He is the principal owner of the companies operating some of the most important telephone territory in the United States, and is also largely interested in the telephone in several foreign countries. He is one of the fortunate men who have amassed fortunes through the invention of Mr. Bell, and of the many successful ones none is more deserving than Mr. Davis. He is a gentleman of ample proportions, frank, open, honest and straight-forward and possessed of much personal magnetism, and it goes without saying that he has hosts of friends, all of whom take a warm interest and delight in his successes.

The firm of Davis & Proal of Baltimore, controlling the Faure storage battery in the States of Virginia, North Carolina, South Carolina, Alabama, Georgia, Florida, Texas, Louisiana and Mississippi, is well known to electric light men. In connection with the storage batteries, Mr. Davis and Mr. Proal run the Viaduct Manufacturing Co., whose works are on the Patapsco River, at Relay Station, on the B. & O. R. R. near Baltimore. Here for some time they have manufactured electrical storage batteries and supplies, and have accomplished much toward the improvement and development of the storage battery. One of their electricians, Mr. A. H. Bauer, has recently returned from a trip to Europe, where he went to thoroughly investigate what was being done in storage matters in England and France.

It is with the Viaduct Mannfacturing Company that the business of the late firm of Davis & Watts is to be combined. As Mr. Davis has an extensive personal experience in this field, is surrounded by some of the most capable electricians and expert workmen in the country, possesses ample capital, indomitable energy and sound judgment, there is no doubt but that with the increased facilities and favorable conditions the Viaduct Manufacturing Company will do an extensive business in electrical supplies of all kinds, and be able to furnish every description of instruments and apparatus for telephone, telegraph, electric light and district purposes, strictly first class in quality and at reasonable prices. A new catalogue is in preparation, which will be issued shortly, and will then be mailed free to any address on application. The change in the business was made very smoothly, and things are now in nice running order again. The Davis & Watts place was not closed for a day.

Spiral Telephone Wire.

The line between Boston and Lowell on which this wire was used has just been completed, and the merits of the new wire have been fully demonstrated. Mr. Gorham Gray, treasurer of the American Spiral Telephone Wire Company, writes us that some 300 or 400 persons have already tested the new line and that a whisper can be readily heard on it and repeated. He adds: "I have to make some slight correction in the phraseology of my claims—the spiral wire *throws aside* induction, gives clear articulation and quicker and greater conductivity, *i. e.*, reproduction, requiring less exertion almost than when talking in the same room, and the larger the wire the quicker and clearer the reproduction. We are to immediately extend the wire through Lowell to Concord, N. H., in all some 90 miles, over the last sixty of which no service can be obtained now by the old wires. We shall then probably extend this line to in all 150 miles or more, as our claim for long-distance talking is now fully confirmed, and we are solicited to consider an arrangement for cables with a view to the use of the wire for a European cable.

The spiral course of the current on our wire throws aside induction, and the central core, being more dense and hard, produces a springy (watch-spring like) life in the wire, and the reproduction of easy, common talk is perfect. Our wires are strung on the poles of the American Bell, and follow among from three to forty-five wires on the same poles and the same cross-arms, and are subject to all the usual drawbacks."

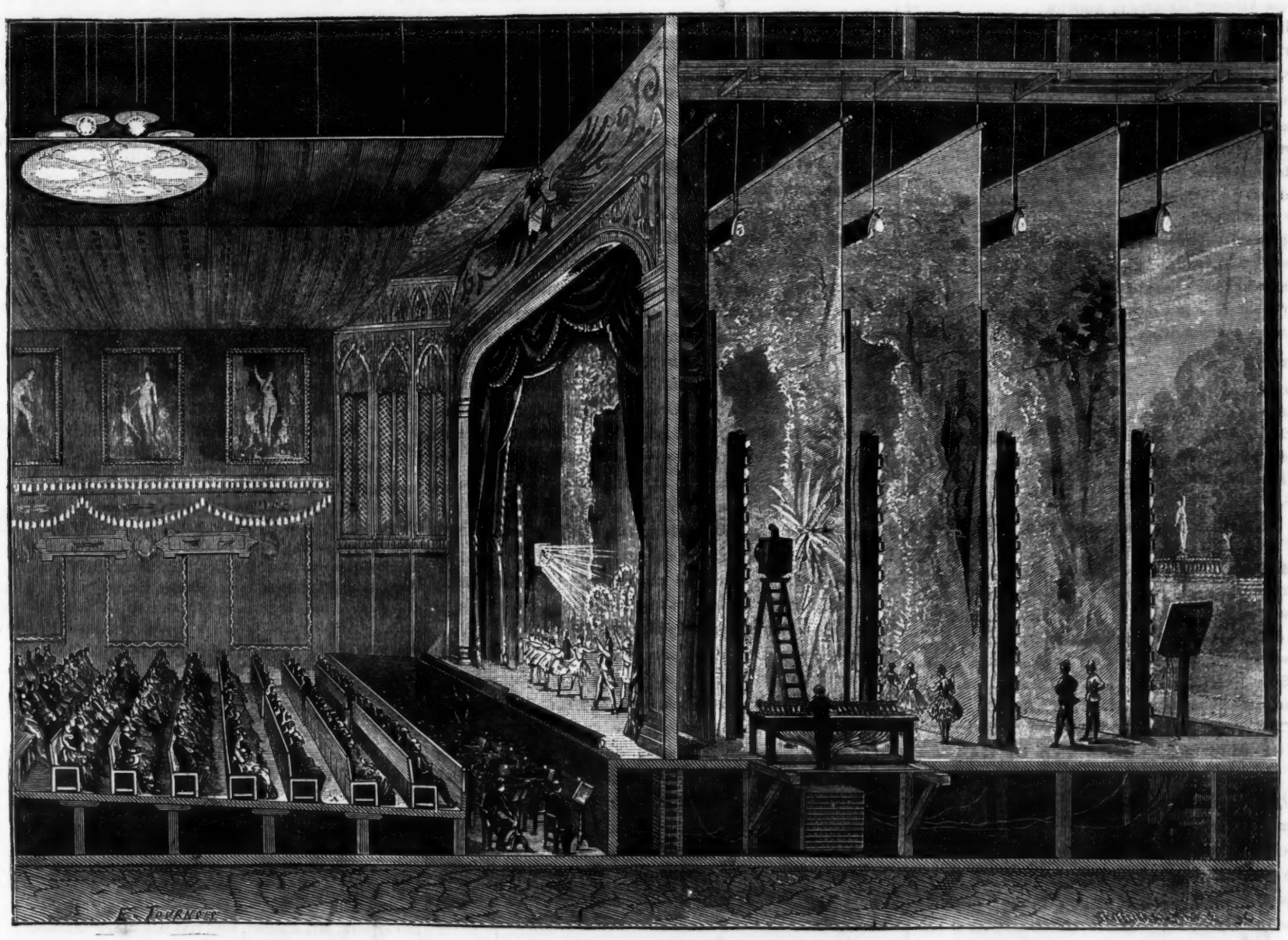

FIG. 7—SIDE VIEW OF THEATRE, SHOWING DISPOSITION OF APPARATUS.

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ELECTRICAL WORLD,

PUBLISHED WEEKLY AT

No. 9 MURRAY STREET, NEW YORK.

W. J. JOHNSTON, Editor and Publisher.

NEW YORK, SEPTEMBER 15, 1883.

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COST OF ELECTRIC LIGHT AND OF GAS.

The rapidly increasing use of the electric current as an illuminant, and the favor with which each additional installation is received, have gradually made imperative the close study of the cost as compared with that of gas. With the general consumer, the financial question ranks first in importance, the quality of the light furnished being a secondary consideration. In certain isolated cases where quality is vital to the success, or is at least a factor in the problem, the cost is of no moment. It is not even necessary that the electric light should be furnished at a price below that of gas in order to secure its universal adoption, but the two rates must be nearly equal; a slight excess on the part of the first will only delay the date at which it will be in the ascendency.

The whole question will hinge on one point, the cost of producing one candle-power of light. The practicability of the electric light is already a conceded success, and may, therefore, be laid one side. For the electric light the question of cost may be divided into the following classes: coal for generating steam; attendance; interest on plant; and deterioration. In manufacturing gas the questions are coal for retorts; coal for gas; attendance; interest on plant; and deterioration. The exact cost of making a quantity of gas yielding one candle-power for any given time can be easily ascertained, and varies in different localities with the price of coal and the efficiency of the apparatus. Together with the other expense items, this makes a total cost below what gas is sold for, leaving a large profit for the companies. In the electric light it seems to be impossible to find a reliable estimate of one of the items. The cost of the plant and of attendance are known, but the quantity of coal consumed for each dynamo cannot be obtained, and without this no accurate idea can be formed. A comparison of the remaining items with those of gas shows a result decidedly in favor of electricity. Recognizing the prominence of the steam question, one of the electric light companies has equipped a station with its best machines and is keeping a close account of every expense item and of the candle-power of light obtained. Such a plan will give results which will increase our knowledge of a much-disputed point. We shall carefully watch the experiments, and at their conclusion hope to present comparisons in figures, which always carry conviction and make a verdict final.

The Siemens-Alteneck Machine in America.

Now that the war of litigation about the Gramme patent is over, with unsuccessful issue to the latter, a campaign of opposition is announced against one of its descendants—the Siemens-Alteneck dynamo-electric machine, the several types of which have acquired a reputation in Europe that is second to that of the Gramme machine. In this case the fight is not to annul a patent, but to prevent the granting of one. The Messrs. Siemens neglected to apply for their American patent, because so little interest was taken in electrical applications requiring dynamo-electric machines in this country, at the time the machine was invented by their electrical engineer, Herr von Hefner-Alteneck. But a few years later, seeing the awakening which the American public had experienced in regard to electric lighting, the application for a patent was filed.

Meanwhile, however, the Siemens dynamo-electric machine had found its way into the country. Prof. Moses G. Farmer had imported one of these machines from England to use in experiments for the United States Government at the torpedo station at Newport, R. I. The machine had also been copied in substance by some American electricians, among whom Mr. Hochhausen, the same whose modification of the Gramme machine was the bone of contention in the recent suit. Mr. Hochhausen, then engaged in the construction of dynamo machines, had made several modifications of the Siemens dynamo-electric machine in his endeavor to adapt it to various purposes such as electric lighting and electro-plating. The Western Union Telegraph Company had also imported the Siemens machine, and had copied it for the purpose of adopting it to Mr. Field's system of dynamo-electric telegraphy, for which purpose it still remains in use to-day.

The Western Union Company, not being desirous to become an infringer, has taken upon itself to present evidence to prove that the Siemens machine had been in public use for more than two years before the date of filing the application for a patent, this being the limit accorded by the United States Statutes. The testimony of Prof. Farmer was taken last week at the Rockingham House, Portsmouth, N. H., where the professor is recovering from a recent illness. The machine imported by Prof. Farmer for the government, and which weighs 3,000 pounds, was exhibited and will be sent to Washington, with the testimony, for the convenience of the Examiner of Interferences.

The Western Union has also come in possession of some of the original machines made by Mr. Hochhausen, which are to be used as evidence in the case.

The appearances seem to be very favorable to the Western Union Company so far as evidence goes; but it is premature to decide, because the value of the evidence remains to be ascertained. A good deal will depend on the construction placed on the words "in public use." The granting of a patent to the Messrs. Siemens would bring about a new and interesting complication in the American electric light world. The Edison machine, which always boasted that it was untouched by the Gramme patent, would find itself this time surely in jeopardy. The same might be said of the Weston machine. A propos of the latter, it seems that Mr. Edwin Weston claims to have been himself the original or prior inventor of the form of armature and in fact of magnetic field which are characteristic of the Siemens machine. Furthermore Mr. Weston is not the only pretender to the priority. Mr. A. G. Holcomb asserts his right in this direction with equal persistency.

It is impossible to speculate on the outcome, but the developments will be awaited with interest. Meanwhile we can point out once more a moral to inventors, and it is this, that it is good policy for inventors to be expeditious in securing their rights.

Legal Relief From Strikes.

"What relief can the State or the Federal Government give in this matter?" has been a frequent question asked with regard to the recent strike against the Western Union Company. To it many answers have already been given; more may be expected. One of the latest expressions of authoritative opinion reaches us from the Northwest. At the time that the Brotherhood were fighting gallantly all along the line, the Milwaukee Chamber of Commerce adopted resolutions requesting the Governor of Wisconsin to direct the Attorney General of that State to render an opinion as to the power of the State to remedy the grievances under which the business of the country suffered from the refusal of the Western Union Company to accede to the demands of its hardworking, underpaid operators and linemen. In accordance with the resolutions and the direction of the Governor, the Attorney General has prepared a document on the subject. It is not without interest and importance.

Passing by his remarks on the exercise of the right of eminent domain, as well as his recapitulation of the well-known facts in the history of the Western Union, we come to his consideration of the remedy or compensation for the evils inflicted on the business community by the cessation of telegraphic intercourse during the strike. That a remedy could be enforced by suit of the State is, he thinks, open to doubt. It will be remembered that this point was raised last year in New York State during the strike of the freight handlers in the summer, and was heard in the courts, with a result by no means satisfactory to the railroad companies. While the Attorney General admits this doubt, however, and deems further legislation desirable to settle the matter definitely, one way or the other, he expresses the opinion that at suit-of-law the company could be compelled to employ a sufficient number of operators to meet the ordinary emergencies of business. It is a pity he should be in doubt and hesitancy on this highly important point, but with the dying Goethe he laudably cries for "More light," and he even goes the length of recommending that the duty be imposed upon the companies, as well as upon their agents, of receiving and forwarding promptly, under penalty for delay, all messages for which due payment is tendered. A statute already exists making the officers of telegraph companies liable to fine and imprisonment for failure, neglect, unlawful performance, and so forth, and he suggests that it be so changed as to impose upon the company a fine for any neglect or tardiness.

In short, the Attorney General, whose views have a refreshing Western breadth, holds that while, as an agent of the Government and an instrument of inter-State commerce, the State cannot prohibit or exclude the company from doing business in the State, ample power belongs to the Legislature to remedy in the usual way all the evils and grievances to which the representative commercial body in Milwaukee has directed attention.

Orders by Telephone.

An action has just been tried at the Niagara Circuit Court, N. Y., involving the validity of an order for grain, made over a telephone wire. Mr. Wilson, one of the plaintiffs, testified that on Jan. 22, 1883, being at his place of business in Rochester, he called up by telephone Faubel & Roux, at Lockport, and, after the preliminary "halloos" had been exchanged, he was informed from the Lockport end that Mr. Faubel was talking to him. The witness had never seen Mr. Faubel, and did not know his voice. Upon counsel proceeding to ask what Faubel said, an objection was interposed, over which an argument arose, the counsel for the plaintiffs insisting that the practical use of the telephone for business purposes had made a new rule of evidence necessary, and that conversation by this means with a person who said that he was Faubel should be admitted. The Court held otherwise, ruling that the identity of the defendant must first be established by some satisfactory evidence. Although there had been correspondence between the parties on the subject it had resulted in nothing like a contract; and the plaintiffs were driven to the hard necessity of calling their adversary to the stand. Mr. Faubel, however, helped them out by testifying that on the day in question he was called up at Lockport by telephone by a person representing himself to be Mr. Wilson, at Rochester, and that a telephonic conversation ensued. Evidence was then given in support of the conversation alleged to have occurred over the wire. Mr. Wilson, while under cross-examination, said that he had used the telephone since its introduction, and had found less trouble in speaking with people away off at Lockport and Buffalo than with neighbors in Rochester. Faubel denied part of the conversation as reported. "Did Mr. Wilson and Mr. Faubel agree, through the telephone, that the defendants should deliver to the plaintiffs six car-loads of white wheat?" was substantially the question which the Court submitted to the jury. The jury found that they did not, and after a deliberation of one hour returned a verdict for the defendants. This result is rather aggravating to the plaintiffs, from the fact that the defendants before the trial offered the plaintiffs $100 in settlement.

A Waste of Time by Burglars.

Burglars are generally supposed to be smart men, able to blind and bluff the ablest detectives. Occasionally they try their skill on a man who is "one too many for them." On Sunday night, the 9th inst., a strenuous but unsuccessful attempt was made to break into and rifle the house of Mr. Loren N. Downs, the well-known and popular general manager of the telephone systems operated by the Lowell syndicate. As one of the local papers puts it, the burglars "might have known better than to rob the residence of a man who lights his gas, feeds his horses and draws his income by electricity." It appears that the family had retired early, after securing the doors. Then the gang of professionals, armed with jimmy, drill and other weapons of their nefarious craft, began operations. The cellar door was first attacked, and that yelded to drilling. But the door into the kitchen from the cellar was a little more than the burglars could manage, and after filling it with numerous drill holes they withdrew to the rear piazza. There the jimmy came into play, a window was pried open, the fly screen was cut and the kitchen was gained. In the dining-room adjoining was the household silver, object of all these nocturnal endeavors. Once again the drills were inserted, and progress was made, but just at an interesting stage of the proceedings when the door that stood between the gang and their booty was about to succumb, the still, small voice of the burglar alarm rang out on the midnight air. With profanity worthy a better cause, the burglars then beat a remarkably rapid retreat, and they were seen and heard no more. By their work on the doors they are known to be skilled professionals. Of course, the family was aroused, probably not less surprised than the intruders to hear that penetrating tinkle, but it is said that Mr. Downs did not discover anything wrong until next morning, when the attempt was reported to the police.

Electric Lighting.—XXXII.

ARC-INCANDESCENCE LAMPS.

We have seen that in all electric candles the light is produced by the voltaic arc, which plays between the two carbons and gradually consumes them. When the carbon pencils of the candle are separated merely by an air space, as in the Wilde, Jamin, and similar types of candles, the voltaic arc alone gives off the light, but when the carbon pencils are separated by an intervening strip of refractory material, the "colombin," as in the Jablochkoff and Andrews candles, the substance of this colombin becomes raised to incandescence by the heat evolved from the arc, and may assist in the production of light. Moreover, its subsequent vaporization by the heat also adds glowing material to the luminous vapor constituting the arc itself.

It would seem appropriate therefore to designate separately by the term "arc-incandescence," the light of the Jablochkoff candle, and of all other arc lights in which the incandescence of a refractory substance increases or modifies the light, to distinguish it from the light of the other class of electric candles and lamps, which is produced by the voltaic arc, purely and simply. There are two types of arc lamps, to be presently described, which justify this classification sufficiently of themselves, because the function which incandescence plays is here still more clearly defined. It might be argued with some reason that the incandescence of the colombin in the Jablochkoff candle is only accessory to its ulterior fusion or vaporization, and that consequently it does not differ materially from the incandescence of the carbons themselves, but in these two lamps the material corresponding to the colombin is of sufficient refractoriness to withstand fusion, and is used only for the purpose of producing incandescence and not to serve as a conductor to the current itself.

THE RAPIEFF LAMPS.

The lamps of M. Rapieff, were first heard of in England in 1878, when their introduction into the press-room of the London *Times* brought them into prominence. M. Rapieff, himself a Russian, evidently aimed, like M. Jablochkoff, to dispense with all complicated mechanism in the construction of his lamps. Instead of producing the voltaic arc between two carbons only, as in all forms of lamps hitherto described, M. Rapieff used four carbons, two for each side. The two carbons of each set are made to slide between guide rollers, and approach each other so as to come in contact at their points and form a letter V. The points of the two V-shaped sets touch so as to form the letter X, only they are in planes at right angles, to each other, so that in front the arrangement would seem like a letter Y, and at the side like the same letter inverted, X. On passing the current an electro-magnet included in main circuit causes one of th e Vsets of carbons to recede sufficiently from the other to establish the arc. As the carbons consume they are fed either by gravity or by means of a weight or spring, so as to butt continually against each other. As the carbons of each V in feeding always come together at the same point in space it results that the points of the two sets always remain at the same distance from each other, and not only is the arc maintained constantly of the same length, but it also remains at the same focus. These lamps still continue in use at the London *Times* office, and give entire satisfaction. Each lamp has a shunting switch whereby the current is made to pass through an equivalent resistance without interruption when one lamp becomes extinguished. The lamps can be connected in series without difficulty.

The lamp which is of special interest in the present connection is a modification of this one, and is shown Fig. 104. In this case the carbons are likewise in two sets of V shape but instead of being disposed one above the other, they are placed side by side and inclined to each other, so that each V set *a a* when seen edgewise forms an inverted Λ with the other set *b b'*. The arc is produced at the tips of the carbons *c* as in the previous form. The angle at which the carbons of each set are inclined to the carbons of the other may be regulated by screws *d d'*. The separation of the two sets to form the arc is made by the same screws, and the distance apart at which they are maintained, or the length of the arc, is regulated by them also.

This disposition of the carbons is favorable in the formation of a voltaic arc which is arched or curved upward. A cylinder of lime *e* is held by a support directly over the carbons, so that the flame of the arc will be directed against its surface. The intense heat of the arc causes the incandescence of the lime, which then emits a light very closely resembling the calcium light. Indeed we might describe this lamp as a calcium light in which the heat of the oxy-hydrogen flame is replaced by that of

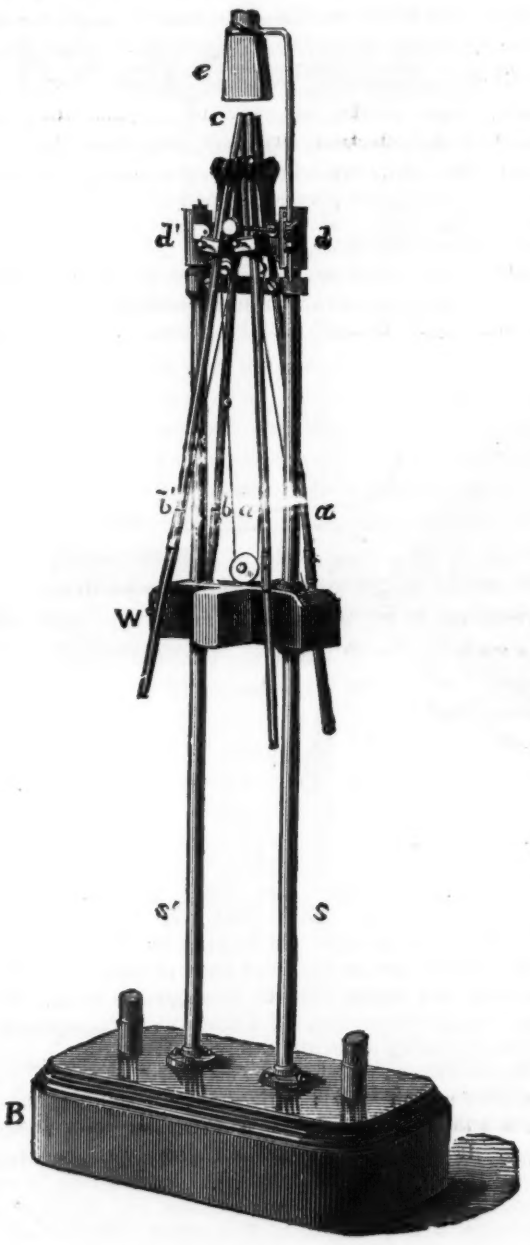


FIG. 104.

a voltaic arc. The lime may be replaced by magnesia or others of the earthy oxides. In analyzing the physical properties of the voltaic arc we found that a great proportion of the current energy developed in the arc is in the form of invisible heat rays. In the Rapieff lamp these rays necessarily act upon the refractory substance to some extent and assist in causing its incandescence. Besides, the lime acts both as a reflector for directing the light in a definite direction, and as a screen which maintains the "atmosphere" of the arc or the space in which it is produced warm, whereby the arc can be increased in length and especially improved in point of steadiness. The disposition of this refractory surface is unfavorable in one respect, however. It directs the light downward, and thus the lamp itself is made to intercept a large number of the rays. This defect might be mitigated by giving to the lime the form of an obtuse wedge, whose point could be brought down nearer to the carbons, in which case the oblique surfaces would reflect the light on either side.

The mode of disposing the carbons adopted by M. Rapieff in his lamps presents many advantages, and has since been copied in several more recent lamps. Each carbon being fed independently of the others, it is possible to replace the carbons while the lamp is in operation, because one of the V set can continue to burn while the other is being changed. When the carbons used are imperfect in structure or impure in composition, this disposition presents advantages, for the variation or fluctuation of the light which would be caused in the ordinary lamps, as the bad portion of the carbon consumed, is partially corrected by the other carbon of the V set. Another advantage is that the currents used may be either alternate or continuous. When an alternate current is used the two V sets of carbons are consumed equally, and when a con-

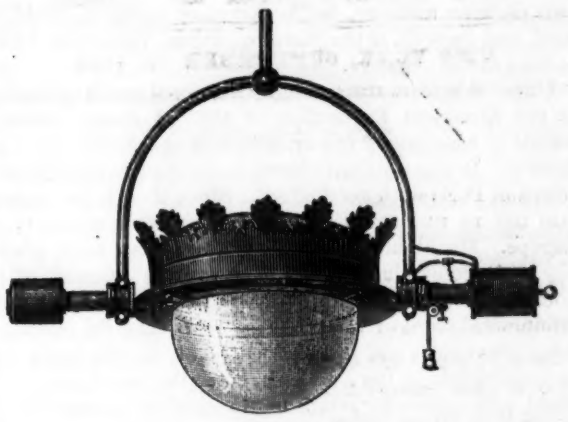


FIG. 105.

tinuous current is used the positive V set is consumed twice as fast; but as we have already seen, the point of the V always remains at the same point, because the carbons are continually pushed together, so all that is necessary is to make these carbons longer than the others.

THE "SUN" LAMP.

This celebrated lamp, which is at present attracting so much attention in Europe, is an innovation which had the Jablochkoff candle for its point of departure. Its originator M. Clerc, was one of the engineers in the service of the Jablochkoff Company, and like M. Jamin he was led to investigate the causes of the frequent fluctuations and extinctions to which the Jablochkoff candle is subject. His observations led him to note the fact that the variations of the light take place when the colombin is consumed too rapidly at certain points, owing to inequality of composition. In such cases the arc leaves the tips of the carbons and roves around on either side, and if the colombin has burned considerably in advance of the carbons the arc can move away sufficiently to permit the cooling of the tips of the carbons, and extinction will be the probable consequence. This fact showed the importance of keeping the tips of the carbons warm. Acting upon this suggestion M. Clerc caused the arc to be produced between two carbons butting against a block of lime, the arrangement being the same as a Rapieff lamp (Fig. 104), having the block *e* in contact with the carbon points *c*. This arrangement obviated the extinction, but did not prevent the oscillations of the arc which make the light flicker. In order to restrict the arc still more, M. Clerc placed thin plates of lime against the sides of the carbons, an opening being left where the plates touched the block of lime, for the emission of the light. But though this improved the steadiness of the light, it did not eliminate the violet tints so characteristic of the Jablochkoff candle. After trying many modifications M. Clerc hit upon one which formed the germ of the first successful lamp. It consisted of a block of lime having two holes converging downward toward each other, and through which the carbons were fed by their weight, their tips barely projecting from the lower surface of the refractory substance. The arc produced between the two carbons rendered the refractory substance incandescent, from which was diffused a golden radiance, perfectly steady and free from all variations of tint, and producing an effect comparable to sunlight, whence the name "sun-lamp."

M. Clerc associated himself with a friend, M. Bureau, in order to study and remedy more adequately the defects of the sun-lamp. The form which it assumed under their combined efforts was remarkable for its simplicity. A cast-iron casing, provided with a suspension arm, like a basket, formed the body of the lamp and served to enclose the refractory material to be rendered incandescent by the heat of the arc, an opening being left below for the light-giving surface. Marble, limestone or compressed magnesia were used as refractory materials in the form of pieces properly fitted together so as to leave openings

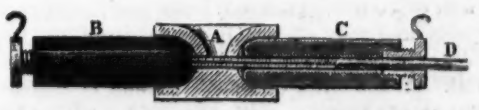


FIG. 106.

through which the two carbons, which were semi-cylindrical, could descend while approaching each other in V fashion. The carbons did not come into contact at their points, as in the Rapieff lamp, however, for the reason that they did not pass entirely through the refractory material, but stopped at a small distance from the under surface. The relative position of the two carbons would be indicated by a V with its point cut off thus V, the space between the two ends being equal to the length of the arc.

The under surface of the refractory material was depressed so as to uncover the inner side of each carbon and expose this space, and a thin strip of blacklead bridged the gap between the two carbons, this strip answering the same purpose as the "fuse" mixture which is used to connect the two carbons of a Jablochkoff candle. On passing the current the strip was fused and the arc established, and then the whole depression was rendered incandescent and became a light-giving surface. As the carbons consumed they dropped down by their own weight. Alternating currents were mostly used in order to keep the consumption of the two carbons uniform, but continuous currents could be used equally well, if the positive carbon were made twice as long as the negative.

Under this form the sun-lamp attracted much attention at the Electrical Exposition of 1881 at Paris, where it served to light one of the art rooms in the Palais de l'Industrie. It was also introduced in some parts of the Grand Opéra in Paris with good effect. Since then it has passed into use in numerous installations in various parts of Europe. Meanwhile, however, the lamp has been gradually undergoing changes, not only for the purpose of reducing it in size and improving its appearance from the ornamental point of view, but for rendering its operation more convenient and satisfactory. The old sun-lamp was as unfortunate as the Jablochkoff candle, in not being provided with means for relighting in case of accidental extinction, in which case it was necessary to insert a new "fuse" of black lead. Besides, there was no independence between the lamps on the same circuit, so that an accident at one would not inconvenience all the others. These were grave defects, and which it proved extremely difficult to remedy without sacrificing that simplicity which was one of the chief merits of the sun-lamp. Within the last year, however, the feat has been accomplished by the electricians interested in its industrial development, and the latest type of the sun-lamp (Fig. 105), whose introduction dates back a few months only, is a handsome specimen of ingenuity and mechanical perfection.

In this type of lamp the refractory substance consists of a single block of marble (Fig. 106) about 2 inches long, 1¾ inches wide, and 1¼ inches thick, provided with three cavities. The carbons (*B C*, Fig. 106) in this case are cylindrical, 20 millimeters in diameter, and disposed horizontally in a line with each other. They enter two of the cavities in the markle block as shown in the figure, the third cavity *A*, on its broad surface, being that from which the light is emitted. The carbon *C* is hollow, and through it slips freely a smaller carbon *D* which passes through a small channel in the marble to come into contact with the carbon *B*, its function being to complete the circuit. When a current is passed between the carbons all that is necessary in order to form the arc is to pull back the small carbon *D*. A small arc forms between the carbon *B* and the end of *D*, and this arc gradually lengthens as *D* recedes, until finally after the carbon *D* has receded back into *C* the arc extends between *B* and *C*. The receding motion of *D* is specially provided for by automatic mechanism, as will be seen later. The details of construction of the lamp can be easily understood from Fig. 107, which shows its interior mechanism. The marble block is situated in the centre of the frame of the lamp, it being enclosed in a cast-iron case. This case has a hinged cover to enable the change of blocks to be made easily, and it is provided with two iron tubes, one at each end, through which the carbons slide into their respective cavities in the marble block. These guiding tubes are, of course, insulated from each other at their inner ends, and they are also insulated from the frame at their outer ends, being fitted into sockets of insulating material. At the outer end each carbon is fitted with a metallic cap screwing into it, and provided with a hook, as will be seen in Fig. 106. This hook serves to establish the circuit connections and at the same time to receive the force that makes the carbon move inward as it is consumed, each guiding tube having a slot extending from one end to the other that permits the motion of the hook as the carbon advances. The hook is engaged by the free end of the lever (Fig. 107) pivotted on a post and worked by a spring coiled around the post itself. This lever is electrically connected with one of the terminals of the lamp, and thus while it conveys the current to the carbon it impels this carbon inward as fast as it consumes. Besides this, it performs another important function, namely, to cut out the lamp whenever the carbon becomes too short. This is accomplished by a right-angled projection from this lever like a bell crank, which moves so as to form a contact with a small upright stop connected by a wire with the other carbon. Whenever the lever has moved its carbon in so far that only a short piece remains, the projecting piece comes in contact with the stop and a short circuit around the arc is thereby completed, so that the other lamps in the same circuit may continue to burn without interruption.

The motion of the slender carbon *D* in lighting the arc is produced by the solenoid on a tube projecting from the body of the lamp, shown at the right in Fig. 107. The armature of this solenoid is a small cylinder of iron which is slipped over the slender carbon and fastened to it so as to move with it in the tube in the direction of the carbon *B* of the opposite side (see Fig. 106), this motion being produced by a small weight suspended by a cord passing over a small pulley. The current passes through the solenoid on its way through the lamp. Under the influence of the current it attracts its armature, which moves outward carrying back with it the slender carbon *D* and thus forming the arc.

The mechanism of the lamp is covered by a hemispherical glass shade. The lamp is suspended by a ∩ shaped arm and presents a novel though quite ornamental appearance, which recalls an incandescent lamp rather than an arc lamp, as seen in the perspective view, Fig. 105. The sun lamp is said to present many advantages. Aside from the simplicity of its mechanism, which leaves little or no chance of derangement, the absolute fixedness and steadiness of the light, even when large fluctuations of current are experienced, are points of superiority over every other arc system. The steadiness of the light is due to the peculiar conditions to which the voltaic arc produced is subjected. In the ordinary arc lamp the arc can "roll" from side to side when the carbons are consumed unevenly, and as the light comes mainly from the arc each fluctuation of the arc is noticed. In the sun lamp, on the contrary, the arc has but one path to pursue. On looking at Fig. 106, it will be seen that the arc is produced only between the extreme points of the carbons *B C*, through the small channel connecting between them. Under the circumstances, the arc is necessarily of an absolutely constant length, because it cannot roll or rove along the sides of the carbon points. The chief reason why the light is so steady, however, is the fact that it comes mostly from the incandescent marble block. It is true that the arc is visible at the central part where the channel opens into the light giving cavity *A* (Fig. 106), but only a small portion, and not the most luminous, is thus exposed. The figure (106) shows that the carbon block is favorably disposed with respect to the arc, so as to receive all the heat given off at the carbon's points (the hottest portions of the arc), in addition to that from the arc itself. The result is that the whole surface of the cavity *A* becomes incandescent and throws off light.

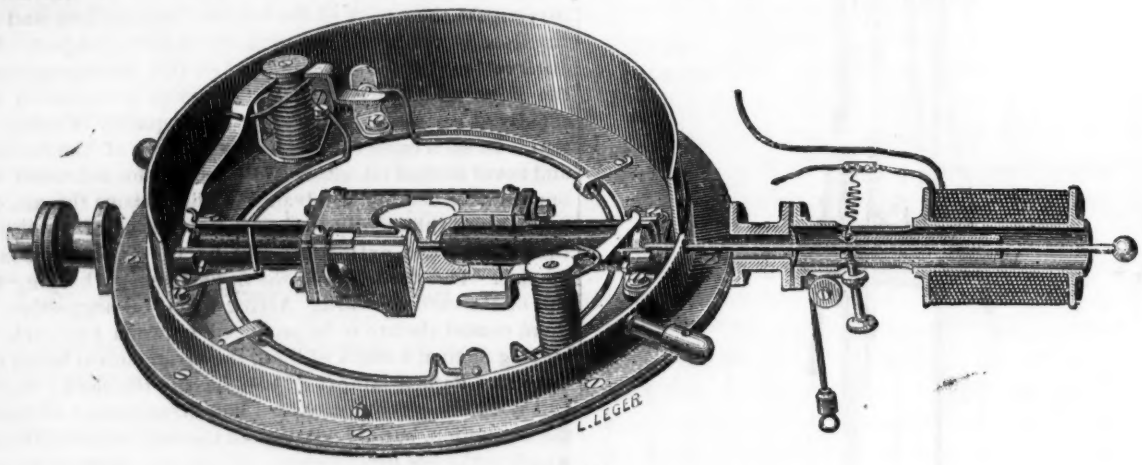


FIG. 107.

It is easy to see now how the current may fluctuate without interfering with the steadiness of the light, for it is plain that it takes a few seconds for the marble block to cool, and this margin is sufficient to bridge over the variations in the current. The light-giving surface of the marble block being considerable, the light has more volume than that from all other arc lights. This of itself is a great merit. The mellow, golden color of the light, which places the sun lamp midway between the ordinary arc light with its bluish colors and the incandescent light with its yellowish cast, is also a great merit of the lamp. This quality renders it adaptable to the illumination of large interiors where the "ghastly" effects produced by arc lights are objected to. Its introduction into the Grand Opera was due to this quality of the sun lamp.

The doubtful side of the sun lamp, and the obstacle its general introduction will have to contend with, is the question of economy. This lamp, as we have shown, is supposed to utilize the invisible heat rays of the voltaic arc, but nevertheless it does not appear to give even as good a return as the ordinary arc. According to the engineers of the company, a lamp of 90 carcels (864 candles) absorbs a horse-power and a half, and a lamp of 120 carcels (1,152 candles) takes exactly two horse-power. This expenditure of power is high as compared with the results produced by our best American arc lighting systems. Besides this, the necessity of renewing the marble blocks is an additional item of expense. They become disintegrated rapidly, and last only from fifteen to thirty hours. The cost of renewal is very trifling, however. The hollow carbons are also more costly than solid ones, but they consume very slowly. They are 100 millimetres long and consume only at the rate of two millimetres per hour, which gives them a duration of fifty hours. The sun lamp has the advantage of allowing the carbons to be completely used up. The guide tubes may even be filled with short pieces, if desired. The current is conveyed through them by contact, and they are successively fed in by the motion of the lever.

The doubts as to the economy of the lamp have not retarded its introduction very materially, however. It is making rapid progress in France, Belgium, and particularly in England, where it is quite popular just at present. The French government has adopted it for many of its public buildings, among others the arm factories at Tulle and Châtellerault. It is used besides in several distilleries and refineries in various parts of the country. In the weaving establishment at Pierrepont the light is used with excellent effect under serious disadvantages. In mills, where the machinery is so apt to cause shadows, the great body of the light of the sun-lamp is very favorable, as it obviates the production of shadows. With four lights the illumination of 28 looms, each occupying a space of 3.70 metres by 1.40, and also some spinning and spooling apparatus, was complete and satisfactory. The lamps swings on its supports in the ∩-sbaped arm, and can be inverted so as to throw the light to the ceiling, whence it is diffused by reflection, or it may be turned so as to project its rays in any desired direction. This of itself is a great advantage.

C. O. M.

The Rapid and the B. & M.

The Boston *Advertiser* says that the agreement perfected between the officers of the Bankers & Merchants' and the American Rapid telegraph companies promises to bring about a satisfactory and successful union of interests between the two companies. While no consolidation of the organizations is contemplated, the control of the American Rapid will pass to the officers of the Bankers & Merchants', and, as the latter company has been successful from the start and is paying 12 per cent. dividends, the operation on the terms proposed seems to be very advantageous to the Rapid stockholders, while the Bankers & Merchants', by securing at once extensive lines, valuable franchises and rights of way and considerable established business, will doubtless be enabled to increase its business largely. It is well known that the last-named company affords its patrons exceptionally good service, and it is promised that the same service will be extended over the Rapid lines, and that the public will thus be the gainer in the quality and extent of the facilities afforded.

In the arrangements between the companies two separate transactions are proposed. The American Rapid Company has $3,000,000 of stock and no funded debt. For the extension of lines it is proposed to issue 6 per cent. 10-years first mortgage bonds, which instead of being sold on the market or delivered to contractors, will be turned over to the Bankers & Merchants' Company, which will build the new lines. This comprises the first transaction.

The second will be between the Bankers & Merchants' Company and the American Rapid stockholders as individuals, and will consists of the exchange of the American Rapid stock for the new bonds held by the Bankers & Merchants' par for par. As the bonds are expected to be worth much more than the present selling price of the Rapid stock, it is believed that this transaction will be agreeable to the holders of the latter, and as the officers of the Rapid control the stock, there is no doubt of the consummation of the plan. Each individual stockholder will be free to exchange his stock for bonds or not as he chooses, but that the control will soon be in the hands of the Bankers & Merchants' there is no doubt. It is expected that as soon as the agreement is ratified on Thursday, the management of the Rapid lines will be assumed by the Bankers & Merchants' Company.

Crazed by the Telephone.

A negro barber called at Police Headquarters in this city on Saturday and said to the Superintendent: You see since the telephone got invented Is'e been a heap troubled by some wicked men back yander in Richmond who speak to me all de time, and threaten to kill me for some deed they allowed I did years ago. Dis mornin' voices came to me over the devil's telephone saying, We'ze gwine to kill you, sho.' I was shavin a man dis mornin' when one of dem Richmond gang put his mouth to the telephone and yelled, 'You scoundrel, I'm gwine to kill you before night.' So, you see I want the Chief of Police to telegraph to have dem men in Richmond locked up." "Where is the telephone?" asked the policeman. "Oh dot's jest what I am axing myself. I can't see it; still it's yer and yander all de same, and I hear the men shouting at me over it all de time." A policeman took the man to the Tombs Police Court, where he was locked up to await an examination as to his sanity.

A New Method of Charging Storage Batteries.

While storage batteries are being charged the electromotive force of each cell opposes the charging current, consequently the electromotive force of the charging current must be high enough to counterbalance the total electromotive force of the series of storage cells. If the electromotive force of the dynamo-electric machine used for charging falls down below the electromotive force of the storage cells, the current in the main circuit will become neutralized, and then the surplus of electromotive force of the storage cells will determine the passage of a current in the opposite direction by which the cell will be more or less rapidly discharged. Now, if the machine has its field coils connected in series, as in the ordinary arc light dynamo-electric machines, the result will be to reverse the polarity of the field magnets, and instantly the machine will begin to produce a current whose direction is the opposite of what it was before, or the same as that being returned by the storage cells. In this condition we may consider the dynamo and the storage cells to be connected in series. If the dynamo is shunt-wound, or with its field in derivation from the main circuit, and from any cause the electromotive force of the machine falls, a result generally due to decreasing speed, the reversal of current in the main circuit produces no reversal of polarity of thefield magnets, because the current passes still in the same direction through these coils. The return current from the storage cells nearly reverses the direction of the current in the armature, and the result is that the dynamo-electric machine is now actuated by the current and runs as a motor and in the *same* direction as before. In other words the only effect produced is that the cells discharge current to increase the speed, and as the speed increases the induction of the field magnets tends to restore the original electromotive force, which is in the opposite direction to that of the storage cells. When the engine regains its speed the dynamo asserts itself again and the charging proceeds as before. It is plain, therefore, that the use of shunt-wound dynamos for charging storage batteries is attended with less inconvenience and less difficulty than the use of series-wound dynamo-electric machines, which require to be watched constantly, so that the circuit may be opened to obviate a reversal of the magnetic field when the electromotive force weakens too far. In some cases a special cut-out device has been used which opens the circuit automatically when the charging current weakens, and before reversal takes place. Besides, at starting it is necessary first to run up the electromotive force by short circuiting the machine, before including the cells in circuit, which must be done by a shunting switch, in order that the circuit may not be actually open at any instant so as to permit the fall of electromotive force.

It is the usual practice at present to use shunt-wound dynamo-electric machines for charging storage batteries, or when these are not available, to use a series machine whose field coils have been cut out of the circuit and connected with an "exciter." A method has lately been proposed, however, in England, by Mr. Gisbert Kapp, by means of which the operation of charging storage cells may be performed as conveniently and as satisfactorily by means of a series-wound machine as with a shunt-wound machine. The method is ingenious and very simple indeed. It consists in connecting the cells to the dynamo-electric machine in such a manner that the potential at a given end of the field magnet coils will always be higher than the potential at the other in order that the current may always follow the same direction around the magnets and thus render a reversal of the current impossible. We have carefully prepared the special diagram herewith presented to give our readers a ready idea of the principle of this ingenious procedure, which is briefly explained by its author in our contemporary, *The Electrician*, of London.

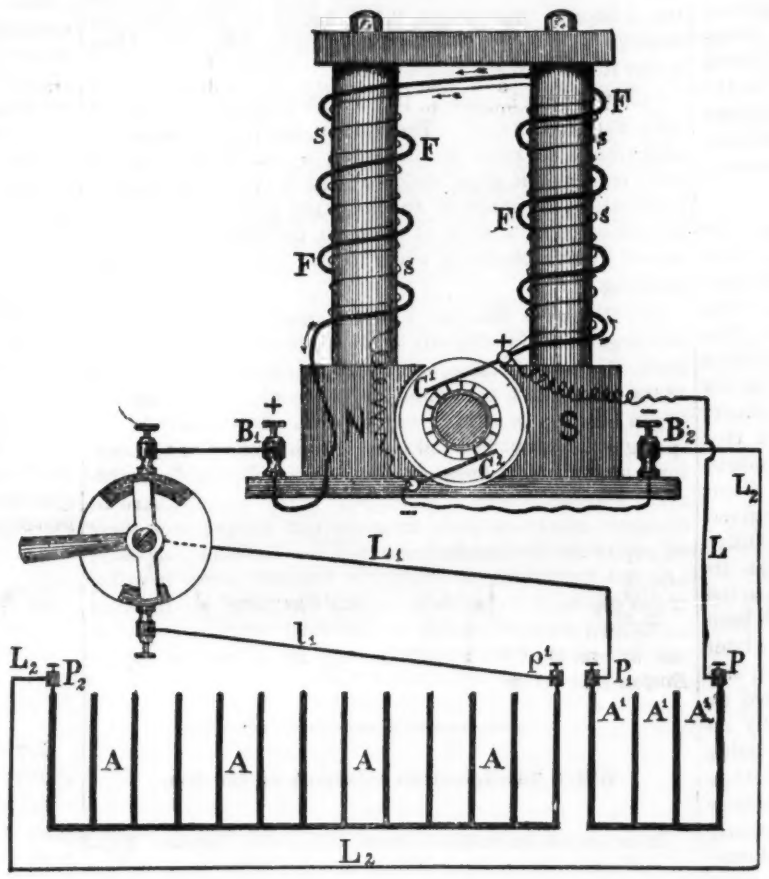
The diagram shows a series-wound machine (the derived field coils *s s s s* are for the present to be neglected) connected to a series of storage cells $A\ A\ A\ A$, $A^1\ A^1\ A^1$.

In this diagram $C_1 C_2$ are the collecting brushes. The current from C_1 passes through the exciting coils $F\ F\ F\ F$ and goes to the positive terminal B_1, while the negative collector C_2 is connected to the negative terminal B_2 of the machine. The main L, leading to the first storage cell, is also coupled to the positive collector C_1. The positive terminal B_1 is connected by a wire to a switch having two contact strips, the upper one of which is long enough so that the contact piece of the switch may leave contact below before doing so above. The lower contact strip is connected by the wire l_1 to the cells at p_1. The conductor L_1 from the cells A^1, is connected to the centre piece of the switch.

When the switch stands as in the figure the two leads L_1 and l_1 are connected together as if P_1 and p_1 were joined by a wire. In this condition the current from B_1 goes to P_1 and to p_1. The terminal P_2, of the battery of storage cells, is connected by the lead $L_2\ L_2\ L_2$ to the negative terminal B_2 of the machine. Thus the current may follow two courses: first from the positive brush C_1 through L through cells $A^1 A^1 A^1$, through $L_1\ l_1$ through the cells $A\ A$ and back by L_2 to B_2; second from B_1 to l_1 to p_1 through the cells $A\ A$ and thence as before to B_2. The cells $A^1\ A^1\ A^1$ are connected with the positive pole at both ends.

Since A^1 is the positive collector, the potential is highest at that point. Consequently the potential at the first cell A^1 is higher than at any other point. B_1 is also the positive terminal, but the current has passed through the resistance of the field coils $F\ F$ to arrive there, and therefore the potential there is lower than at C_1, and this potential is of course evidently higher than that at P_2, which is connected with the negative terminal B_2, where the potential is lowest. Now since the potential at C_1 is always greater than at B_1, it is clear that the current will always flow in that direction around the field magnets, no matter what may happen in the external circuit.

The difference of potential between P and P_1 should bear a certain proportion to the resistance of the exciting coils $F\ F\ F\ F$ of the field magnet, and to the current in the external circuit. We may represent the resistance of $F\ F$ by R, the external current by C, the potential at P by A and the potential at P_1 by B. There are three conditions possible: first, where the difference of potential equals the product of the current and the field resistance,



or $A-B=C\,R$; second, where the difference of potential is greater, or $A-B>C\,R$, and third, where it is smaller, or $A-B<C\,R$. In the first instance the cells $A'\ A'\ A'$ comprised between P and P will neither charge nor discharge, but simply balance as it were the electromotive force necessary to drive the current round the field magnets $F\,F\,F\,F$. In the second case the cells $A'\ A'\ A'$ will partly discharge and assist the external current to excite the field magnets $F\,F\,F$. In the third case the cells will become charged, though at a slower rate than the other cells $A\ A\ A\ A$. It is best to make $A - B$ as nearly as possible though not equal to $C\,R$. For instance, supposing the machine to be designed for furnishing a current of 50 ampéres, the resistance of the field magnet being 9.1 ohm, then two cells should be placed between P and P making $A\,B = 4.4$ volts, which will nearly balance the 5 volts necessary to urge the current round the field magnet F.

Mr. Kapp states that this method of charging has been found particularly useful and convenient in the case of small electric light installations in private houses, where a gas engine with a dynamo-electric machine and accumulators are employed. He mentions, as an instance, a plant of 100 incandescent lights lately put into a private residence in London. In this installation a "compound" dynamo is used, that is to say, one having both a series and a derivation or shunt field coil, the shunt coils being represented in the diagram at *s s s s*. This self-regulating dynamo machine is worked by a gas engine of 3½ horse-power, and is coupled in parallel circuits with the accumulators and the lamps.

One of the chief requirements, in an installation of this kind, is that the presence of a skilled electrician as attendant shall not be required, and in this case the duties of the attendant are extremely simple.

When not running, the switch (shown in the figure) is, of course, turned so as to open the connection between B_1 and L_1 so as to prevent the useless discharge of the cells through the coils F. When it is desired to begin charging, all that is necessary is to turn on the gas to the engine, light the jet and turn the switch so as to permit the residual charge left in the cells from the previous day to pass through the dynamo-electric machine, and to run it as a motor, thus causing or assisting the engine to start, after which the machinery may be left to itself through the whole day, and at night also, when it is desired to use the dynamo as a source of additional supply of current to the lamps.

Some of the Novelties at the Vienna Exposition.

The London *Times* publishes an interesting article from its Vienna correspondent on the exhibits at the Vienna Electrical Exposition. Though nominally opened on the 18th ult. the exhibition was really not in anything like working order till the 23d. In spite of the postponement of more than a fortnight, some of the sections were not then finished, and one section was hardly commenced. I am sorry to say that it is the English section, says the correspondent, which is more backward than any other. In fact, it is useless to speak on an English section, for such a thing does not exist. England is the only country which is totally unrepresented; even Turkey makes a better show. The only English exhibitor I have seen is Mr. Killingworth Hedges, who shows a safety plug for the Swan lamp, where Edison's lead wire, which fuses when the current power becomes dangerously intense, is replaced by a piece of what he calls albofoil (an alloy of aluminium and tin), which under the influence of intense heat is volatilized—unlike the lead which fuses and might cause ignition of substances which come in contact with the molten mass. The largest machine in the exhibition is the alternate current machine (system Mechwart-Zipernowsky), manufactured by Messrs. Ganz & Co., of Buda-Pesth. It resembles a large fly-wheel of ten feet diameter; the armature has a diameter of eight feet. The continuous current-exciter is placed inside the alternating machine, and the whole apparatus is driven by a 160 horse-power compound steam engine. It feeds 1,600 incandescent lamps in various parts of the building, at a speed of 140 revolutions per minute. At a speed of 180 revolutions, and by a displacement of the collecting brushes, it can supply the current for 2,500 Swan lamps. Messrs. Schuckert, of Nuremburg, exhibit a new compound machine of very solid and elegant construction, which, at the very low speed of 500 revolutions, supplies the current for 350 Edison A lamps. The Schuckert machine, which is well known in England, is used in connection with the Pilsen lamp, and both Schuckert and the Pilsen company are worthily represented. The Anglo-Austrian Brush Company, the Gramme, Edison, and Weston-Maxim companies, as well as Jürgensen, of Copenhagen, and Fein, of Stuttgart, are represented in this department.

Messrs. Siemens and Halske exhibit in the Austrian section. Theirs is a splendid show; the machines are of the well-known type, continuous and alternating. I also found among them the unipolar machine, which I had not seen before. This remarkable machine, which really constitutes a class of its own, has a long electro-magnet, with a core formed of a number of plates, which protrude on each side of the coil, and form on both sides of the coil two hollow cylinders. Each of these hollow cylinders constitutes one of the poles of the electro-magnet. The object gained by this arrangement is a considerable increase of electromotive force.

One of the best machines is shown by Messrs. Schwerd & Co., of Carlsruhe. It is a continuous current dynamo, either for 25 incandescent lamps of 16 candles each, or, by a simple mechanical contrivance, for two arc lamps of 2,000 candles each. The characteristic part of the machine is to be found in a prolongation of the pole shoes penetrating into the induction coils, thus exciting them inside as well as outside. These machines feed five large arc lamps of 4,000 candles each, of the same inventor, on the top of the rotunda. The same firm also exhibits a dynamo of somewhat novel construction. The armature is wound, not in the form of a ring like the Gramme, or diametrically, like the Siemens, but segmentally, which insures a very perfect induction. A large dynamo of this kind feeds 300 high-resistance Swan lamps at a speed of 600 revolutions. Messrs. Egger, Kremenezky & Co. supply the current for a large number of lamps in the building, and also for a large arc lamp, with reflector, of 20,000 candle-power; used for the illumination of the Stephenskirche. Their machines are cylindrical compound; that is to say, they are constructed in such a way as to allow the short circuiting of any number of lamps in the circuit, without a special current regulator.

The correspondent also refers flatteringly to the Bernstein lamp, exhibited by the Bernstein Electric Light Manufacturing Company of Boston, Mass.

ELECTRIC LIGHT FOR LIGHTHOUSES.—The United States lighthouse board is negotiating for the lighting by electricity of six lighthouses on Chesapeake Bay.

The Rise and Progress of the Electric Light in Boston.

The first company regularly organized for the electric lighting work in Boston was the Brush Electric Light Company, which was incorporated and began business in May, 1881, with three lights in operation. Its business has grown since, with the usual fluctuations attendant upon such an enterprise, until now it has in operation in Boston 612 lamps. Of these, 190 are city street-lights. About three-fourths of these lights are run from the central lighting station on Lancaster street, near Merrimac, and the rest chiefly at the South End and Roxbury, from a branch station in Reed's block, Harrison avenue, near Dover street. The dynamo-machines, or electrical generators, used by this company are, like the lamps, the invention of Charles F. Brush, of Cleveland, Ohio. The standard machine used by this company is the 40-light dynamo, though three circuits of 56 lamps each are run, a 16-light dynamo being employed on each of these circuits to supplement the 40-lighter. The company uses 14 40-light and three 16-light dynamos, thus giving a present nominal capacity of 608 lamps, which will soon have to be increased to keep pace with orders. At the central lightning stations several kinds of engines are used to produce the power, Armington & Sims, Fitchburg, Brown, etc., aggregating some 600 nominal horse-power.

The Brush Company expects in the course of the coming winter to introduce into this city its system of incandescent lighting, which is by means of the Brush storage batteries and the Swan incandescent lamps, an English invention which this company controls for the United States. The Swan lamps are manufactured at a factory run by the Brush-Swan Electric Company of New England, on Hampden street. They are similar to the Edison lamps in appearance, the carbon filament being of cotton thread, carbonized, in form a high arch, with a loop at the top.

The New England Weston Electric Light Company was organized and established in this city about three years ago, under licenses and franchises owned by the Weston Company of Newark. At a later date the Weston Company was merged with the United States Company of New York, and thus the New England Co mpany came also into possession of the rights controlled by the United States Company. These include the patents of Weston, Farmer, Maxim and various other inventors to the number of two or three hundred. The United States Company stands in the relation of parent to the New England Company, the latter controlling the New England States. The Boston office is at No. 18 Post-Office square. The company, in March, 1882, began its lighting business in this city by putting 20 lamps into the Old Colony Railroad station, which were run from a temporary lighting station on Beach street. A few weeks later permanent quarters were obtained on Eastern avenue, and in August of the same year a station was established on Stanhope street. The company's business has steadily increased, and it is now running as many permanent lights as it ran during the holiday season in 1882. The Stanhope street station, which has a capacity for 200 lights, is now running 150, but preparations are already making to nearly double the plant immediately, by the addition of 200 horse-power, and at the same time the foundations are to be laid for 200 horse-power more, providing for the addition of 400 horse-power in all. The Eastern avenue station has a capacity of 320 lights, and is now running 180. South Boston and the city proper, south of Winter street, are covered from the Stanhope street station, and the North End and Charlestown from the Eastern avenue station. There are private plants under the Weston system in the city, running an aggregate of 169 lights, and the figures above do not include the plants at Hull and Chelsea Beach. The company is preparing to introduce its incandescent lights, known as the Maxim, but really much improved by Mr. Weston's inventions.

The American Electric and Illuminating Company was organized in June, 1882, and began business with 20 lights, its central station being the basement of the Mechanics' building. Its business grew slowly until December, when it began to feel the impulse of prosperity, and, since that time, its increase has been rapid and steady. It has recently arranged to dispose of its lighting plant in this city to a sub-company, the Merchants' Electric Light and Power Company, just organized to carry on the illuminating business in Boston, while the parent company will be a construction company entirely, putting in complete electric lighting plants in any places in New England or New York State not now supplied with this system, and selling these plants to local sub-companies, which will run the lighting business. The apparatus used by this company is the Thomson-Houston system of dynamo machines and lamps, which latter are of the long arc type. This company, as has been stated, has its central lighting station in the basement of the Charitable Mechanic Association building, on Huntington avenue. Here are a 150-light plant, driven by the huge Wheelock engine, and two 100-light plants, each driven by two Armstrong & Sims engines of 50 horse-power each. Each of the latter complete plants consists, beside the engines, of four 25-light Thomson-Houston dynamos. In and about this building, now occupied by the foreign exposition, are 100 of the Thomson-Houston arc lamps, while 200 more, scattered about the city, including the 30 lamps on the Public Garden and 50 in the Institute fair, are driven from this central station. At the Institute building the company has 250 lights in operation, 50 driven from the central station, as described above, and the other 200 by one complete 100-light plant, similar to those already described, and two 50-light plants, driven by engines of other exhibitors. The property is about to be transferred to the new Merchants' Company, which is said to contemplate an immediate increase of its facilities, to meet the demand for more lamps; possibly by the establishment of another lighting station nearer the centre of the city.

The Fuller Electrical Company, which has a New England agency at 37 Pearl street, uses the Gramme dynamo machine and the Wood arc lights. It has no lighting station and no lights in this city, except an exhibition plant at the Institute fair.

The Arnoux Electric Light Company, which has an office in Sears building, runs six arc lights at the Hotel Vendome, where a small engine and dynamo machine are in operation. It has no other lighting plant in this city.

The purely incandescent lighting system was first introduced into this city by an agent of the Edison Company for Isolated Lighting, of New York, in June, 1882. A plant of Edison lamps was then put into the Hotel Vendome. In September of the same year the company established a New England department, with headquarters in this city, Mr. Spencer Borden being appointed manager. Since that date the spread of the system has been rapid, until now the company has about 3,500 lamps in practical use throughout the city, besides an exhibition plant of 1,004 lamps in the Foreign Exposition.

The company has about 18,000 lights in operation in the New England States. The Edison lamp is familiar in appearance to most people, being a pear-shaped bulb of thin, transparent glass, inside of which is seen a delicate filament, in the shape of an elongated and inverted letter U, composed of a fibre of bamboo, carbonized, and connected by fine platinum wires to the service wires in the building.

The Bernstein Electric Light Manufacturing Company was organized in this city in April, 1882. The charter is under the laws of Maine, and the capital stock is $500,000, in 10,000 shares of a par value of $50 each. The company began business in a small way on Arch street, early in the spring of 1882, but last fall removed its factory to Charlestown street and its business office to the Equitable building. The business of the company is the manufacture of dynamo machines and incandescent lamps, and their supply to sub-companies organized for lighting purposes; also the furnishing of complete isolated plants to mills, factories, etc. So far the company has done no lighting on its own account, except in the mail weighing-room in the basement of the Post-Office and in its own factory.—*Boston Advertiser.*

Weird Electrical Exhalations of the Sea.

In an article on marine superstitions, the London *Telegraph* says: Of all superstitions of the sea the most intelligible are those which gather about the weird electric exhalations called composants. A green, faint and sepulchral light shining at a yard-arm or boom-end on a pitch-black night and amid a gale of wind, might well puzzle and agitate the simple heart of a seaman staring aloft at it. Shakespeare embodies the shining appearance in the person of Ariel, and spiritualizes it by his own conception: "Now on the beak, now in the waist, the deck, in every cabin, I flamed amazement; sometime I'd divide, and burn in many places; on the topmast, the yards and bowsprit, would I flame distinctly, then meet and join." It is quite possible that one finds here the groundwork of the belief formerly entertained that "St. Elmo's fires," or composants, as they are usually called, were women, who took this form to bewilder seamen. There are stories of sailors giving chase to a composant, following it from a lower yard-arm to the truck, and then being spirited off by the spirit of a female that suddenly gleamed out in the darkness, with the composant shining on her hair like a star. Another superstition was that composants were the souls of seamen that had died aboard the ship, and who, in flaming form, haunted those yards and spars which they had often when in life hung on by their "eye-lids." No sailor liked one of these lights to shine upon him. If the reflection fell upon his face, he would go below with the conviction that something evil was sure to happen to him.

Exhibition of the Waring Underground System.

A little less than a year ago we recorded a public test of the experimental cable of this company, extending from the company's office in Pittsburgh to Waring Station, on the Allegheny Valley Railroad, a distance of eight miles. After the first test, which was pronounced satisfactory, faults developed in the cable, which the company has since been industriously engaged in eliminating. On August 30 another public test of the cable was made, among those present being: Manager B. F. Lloyd and Cashier Clark, of the Western Union Company; Chief Operators Williams, Markle and Eitemiller, and Superintendents Rowe and Bernard, of the same company; Messrs. Ridall and Ingolds, agents of the Brush Electric Light Company in Pittsburgh; Samuel A. Duncan, superintendent, and R. McGonnigle, secretary of the Allegheny County Light Company; Thos. McTighe and Jos. T. McConnell, of the McTighe Electric Company; Henry Metzgar, general manager of the Central District Telephon Company, and representatives of the press. Telephones and Morse instruments were used simultaneously, and tests were made of the wires separately, and joined together in a single circuit of forty-three miles. The usual expressions of satisfaction were rendered by those who witnessed the test. Superintendent Duncan stated that the cable was perfectly free from interference, except that coming from using the same ground for the Morse and the telephone; but when using the Morse and the telephone simultaneously one could talk and hear just as well as without the Morse. Mr. Eitemiller stated that the only difference he noticed in using the eight and forty-three mile wires was that the increase in length seemed to make the current stronger. We gave a description of this cable in a former issue.

"Underground Communications."

To the Editor of the Electrical World:

SIR: In the article headed "The Underground Controversy in Philadelphia," in your paper of June 30, 1883, the writer speaks of the great danger of laying electric light wires alongside of telephone wires, owing to the probabil ity of the currents from the light wires passing over to the other wires, etc. With the present degree of perfection in the manner of insulating the light wires, it is not possible for the current to leave the wire in sufficient quantities to produce heat enough to carbonize the materials from which the conduit is made, even were it allowed much time to do it. Were this the case, many of our fine buildings would have been destroyed long ago. I have known high tension currents to pass along an electric light wire which was imbedded in material easily carbonized and in close proximity to other wires, and this for three years, with not the least perceptible effect on either the material in which it was laid or on the wires lying near it. It would be a very difficult matter for so slight an amount of electricity as the "leak" to produce any visible effect. The question of danger from fire has been pretty thoroughly investigated by insurance men, and the point raised by "Electrical Engineer" is hardly worth arguing.

H. E. WALTER.

RICHFIELD SPRINGS, N. Y.

THE TELEGRAPH.

CUTTING A TELEGRAPH WIRE is not breaking the news gently.

TELEGRAPH EXTENSION.—The Southern Telegraph Company is rapidly extending its lines from Charleston, and from Charlotte to Columbia.

ANOTHER NEW COMPANY.—The Philadelphia *News* says that work is to be commenced October 1 on a new telegraph company, with wires from Portland, Me., to Washington, D. C., and that will have Western connections. Mr. Geo. B. Pennock, the present Philadelphia manager of the American Rapid, is to be general superintendent of the new company. No other names are given.

THE SHAREHOLDERS WILLING.—Stockholders representing about five-sixths of the capital stock of the American Rapid Telegraph Company met in Hartford, Conn., Sept. 13, and voted, practically unanimously, to ratify the contract with the Bankers & Merchants' Telegraph Company, to take control of their lines and extend their wires through the Southwest, which will require an expenditure of $3,000,000.

A TELEGRAPH SUIT.—A dispatch from Philadelphia says that a suit has been begun in the Court of Common Pleas by the Western Union Telegraph Company against the Manley Telegraph Cable Company for the recovery of $2,000 advanced the latter company in November, 1880, as a preliminary payment upon a contract for laying three cables on Chestnut street between Third and Tenth. The work was never done, and the company subsequently became insolvent.

SOUTH AMERICAN TELEGRAPH FACILITIES.—The Coffee Exchange recently sent congratulations to Rio de Janeiro on the opening of the new telegraph line extending from the latter place along the west coast of South America and across Mexico to Galveston, Tex. By that line a dispatch can be sent to Rio de Janeiro in two hours. Hitherto dispatches have had to go by way of London, and a message sent from New York at 2 o'clock in the afternoon would not reach Rio de Janeiro until 9:30 the next morning.

IN FAVOR OF A POSTAL TELEGRAPH.—The Toledo Produce Exchange has adopted the report of its committee recommending the passage by Congress of a law providing for the construction of government postal telegraph lines on the basis of the proposed bill of Senator Edmunds. The report opposes the purchase by the government of ex-

isting lines or any that may hereafter be built by private companies, and favors the establishment of an independent system, to be extended as fast as the business interests of the country may require.

ACQUIRING THE AMERICAN RAPID.—The plan by which the Bankers and Merchants' Telegraph Company is to acquire control of the American Rapid is for the capitalists interested in the former to take $3,000,000 in bonds of the latter, issued for the extension of the Rapid's lines. The bonds, in turn, are to be exchanged for stock of the Rapid at present in existence. The arrangements are completed by which a majority of the stock will be exchanged for bonds. The stock is to be lodged in the name of Mr. A. W. Dimock, the President of the Bankers and Merchants Company. The extension of the Rapid's lines will be to St. Louis, Pittsburgh, Toledo, Detroit, Cleveland, Cincinnati, Louisville and other Western points.

REDUCTION IN WESTERN UNION EARNINGS.—The financial statement presented by President Green to the directors of the Western Union on Wednesday estimates the net revenues of the company during the quarter ending Sept. 30 at $1,650,000, against $2,289,489, the actual net earnings during the same quarter of last year. This shows one of the effects of the strike. According to Dr. Green's report, the gross revenues of the company for the fiscal year ending June 30 were $19,454,902.98, the expenses $11,794,553.40, and the net profits $7,660,349.58. This is an increase over last year of $2,340,727 gross and $542,279 net; but the increase last year over the preceding one was much greater, namely, $3,053,355 gross and $1,477,429 net. A resolution was adopted declaring a quarterly dividend of 1¼ per cent., payable on and after Oct. 15, and "on removal of legal restraint prohibiting such payment." The annual meeting of the company will be held Oct. 10, and it was resolved that the stock books shall be closed Sept. 20 and reopened Oct. 16.

THE WILLIAMS-HATCH SUIT.—The true story of the effort to compromise the Williams-Hatch suit against the Western Union Telegraph Company came out last week. A gentleman who knew the circumstances said that President Baldwin, of the Louisville & Nashville Railroad, went to Jay Gould, who was understood to be bearing the stock, and asked him and Russell Sage to enter the board of directors. Mr. Baldwin urged that the road would be a valuable tributary to Mr. Gould's Southwestern system. Mr. Gould referred Mr. Baldwin to Mr. Sage, who, after deliberation and consultation, said Mr. Gould and himself would go into the board if W. S. Williams, a director of the Louisville & Nashville, would withdraw his suit against the Western Union Telegraph Company. Mr. Williams declined, on the ground that railroad matters had nothing to do with his suit. In order not to hinder any plan of Mr. Baldwin, he sent in his resignation as a director of the Louisville & Nashville, but it was not accepted. It turned out, however, that on Wednesday last Mr. Baldwin, who had within a few days purchased considerable Western Union stock, was elected a director of that company. He said afterward that he had not bought Mr. Williams' Western Union stock and that his going into the directory of the telegraph company had nothing to do with Mr. Williams' affairs.

THE TELEPHONE.

EXTENSION IN OHIO.—The Bell Telephone Company, of Cincinnati, is erecting a line from New Richmond, O., to Cincinnati.

AMERICAN BELL STOCKHOLDERS.—It is said that there are less than 1,000 stockholders in the American Bell Telephone Company.

A GOOD-SIZED ORDER.—The Palmer Wire Company, of Palmer, Mass., has just secured another contract for furnishing about $150,000 worth of telephone wire.

TELEPHONE OPERATORS' PPOSPECTS.—A correspondent in this city sends us the following Sunday-school conundrum: Why should telephone girls go to heaven? Because they have had such a Hell-ohf a time on earth.

SOCIETY GOSSIP.—There is a young lady in New York City who makes, it is said, about 360 calls nearly every day of her life. Oh, you need not look disconcerted, miss—she works in a telephone office.—*Yonkers Statesman.*

TELEPHONE IN HONOLULU.—The telephone exchange in Honolulu, Hawaiian Islands, has 350 subscribers, out of a population of 14,000, or one to every 40 inhabitants, which is said to be the largest proportion of any place in the world.

THE TELEPHONE IN TEXAS.—A letter from Texas says that on September 1, four new exchanges, with 227 subscribers, were opened, and 167 miles of new extra territorial wire were opened by the Erie Telephone Company, which includes the former Southwestern.

MEXICAN TELEPHONE.—The manager of the Mexican Telephone Company is forwarding large invoices of supplies for the parent and sub-companies. Some 500 sets of instruments have been shipped to Mexico since the new management came into office. The contract which permits the Mexican company to ship and use the Bell apparatus in Mexico expires next February.

WOMAN'S WRONGS.—The Burlington *Hawkeye* remarks that a man makes an awful row if his wife takes his razor to trim a little maize on her little toe or sharpen a lead pencil, but he thinks it is all right, and scoffs at her, if she shrieks her feeble protests when he takes her little embroidery scissors to cut a copper telephone wire. "Don't hurt the scissors at all," he says.

A WICKED SUGGESTION.—The practical joker of the Boston *Post* suggests this mean scheme: "If you wish to make a man perfectly miserable, send him an important message by telephone. Tell him to be sure to meet you at a hotel at a certain hour, say. But when he asks you who you are don't understand him and don't give him your name. He'll fret off a pound of flesh trying to make out who it is that has telephoned him."

TELEPHONE SERVICE IN CHICAGO.—The Chicago *Tribune* says: "The telephone humbug was in full operation again last night. If there is a city in the United States which has a lazier, more inefficient, or more impudent telephone service than Chicago we should like to know its name and to extend it sympathy in advance. The telephone service as at present conducted in this city is a public fraud and nuisance."

INCREASING THE CAPITAL.—At a meeting of the Suburban Telephone Company at Lowell, Sept. 11, it was voted to abandon the scheme for a consolidation of the New England companies, and it was also voted to increase its capital to $175,000, for construction purposes. The Bay State Telephone Company has taken a similar action in regard to a consolidation, and has voted to increase its capital to $200,000. Both companies report a large increase of business in their territory.

THE SPIRAL WIRE.—The new spiral telephone wire being used between Boston and Lowell has given so much satisfaction that a similar wire is being strung between Boston and Worcester. One peculiarity of this wire is that while it may be crossed with an ordinary wire, through which it is impossible to talk, the conversation over the spirrl wire is, it is claimed, perfectly carried on. It is also much lighter and cheaper than ordinary wire, weighing only 75 to 100 pounds per mile.

RESIGNED.—Mr. John A. Blattan, superintendent of the exchanges of the Chesapeake & Potomac Telephone Company, at Cumberland, Hagerstown, etc., has resigned that position to go to Spain as general manager of the Spanish American Telephone Company and vice-president of the Spanish Signal Telegraph Company. He was accompanied by Mr. E. D. Eve, an old telegraphist, and the author of the famous Lineman's Poetical Report. Mr. Blattan will be succeeded by Mr. Frank Kennedy, now manager of the Hagerstown exchange.

GOVERNOR ANDREW'S SON.—The North Adams, Mass., *Transcript* says that the younger son of the famous war governor is engaged by the Pittsfield telephone management as repairer and lineman. Mr. Andrew is learning the business with a view of a responsible office in the eastern part of the State. He has spent one year in a factory, and is now learning all the practical working of a telephonic exchange. To don old clothes and visit residences where in full dress he has attended evening parties, requires a kind of nerve which ought to make a successful telephonist.

BELL TELEPHONE STOCK.—Bell telephone is very strong again, but toward the close of the First Board weakened with a sale of 35 shares at 240¾, against 241 at the opening. The closing bid was 240¼. In the afternoon the market advanced to 241. Mexican telephone sold at 2⅜ for 100 shares. The latest news from this company is cheering. The demand is said to average 10 telephones per day. From an interview with one of the management the following concerning the prospects of the New England telephone interests was written: Now that the New England consolidation of telephone interests has been abandoned, the matter of increasing and further developing the business will be rapidly and vigorously pushed, and it is said the increase for the section under Lowell management for the next few months will exceed anything in the previous history of their companies. While negotiations for the consolidation have been pending, business has been somewhat at a standstill, everybody awaiting developments. Now that a settlement has been reached, the continuation of the zeal and ability of the past is well under way. Some radical changes and improvements in the management of these interests are under advisement by the Lowell syndicate, and special attention will be given to the redistricting of the suburban company, the building of several important extra territorial lines in the States of New Hampshire, Vermont and Massachusetts, and, in fact, opening up all the undeveloped territory possible. With this action in view, and by request of a large number of stockholders, the executive committee have deemed it advisable to call a meeting of stockholders in the Bay State and Suburban companies in Lowell, Sept. 11, at which it is probable that the vote to consolidate will be rescinded as unanimously as it was passed.—*Boston Herald, Sept.* 9.

THE ELECTRIC LIGHT.

ELECTRIC LIGHT IN NEW ORLEANS.—The New Orleans Brush Company is to run 600 lights the coming winter, a gain of 150 over last season.

ELECTRIC LIGHT IN FALL RIVER, MASS.—The Edison Electric Illuminating Company, of Fall River, has organized with a capital of $100,000, all subscribed for.

KANKAKEE, ILL.—Arrangements are almost complete for lighting the city by electricity by nine towers. A number of business houses will also have the light.

THE BRUSH ELECTRIC LIGHT COMPANY, of Baltimore, is building a new central station to contain a 500-light plant, and to be additional to its present 400-light plant.

EDISON LIGHT IN MASSACHUSETTS.—The Edison Electric Lighting Company at Brockton proposes to open its central lighting station on Monday next. The Lawrence station will be opened within two weeks, and that at Fall River in November.

ELECTRIC LIGHT AT THE STATE FAIR.—A contract has been closed with the American Electric & Illuminating Company, of Boston, to light the park and exhibition building at the State fair grounds, at Lewiston, Me., from the 18th to the 21st of September.

THE LIGHT AT 195.—The Western Union building in this city is being furnished with electric lamps throughout The operating room was lighted in this way some months ago as an experiment. About 25 additional lights are being placed in this room, principally on the walls of the office. The system used is the incandescent one of the United States Company.

WANTS TO LIGHT THE PUBLIC BUILDINGS.—Representatives of two electric light companies appeared before the Secretary of the Treasury, at Washington, Sept. 11, and asked that they be allowed to light the building with the electric light. Secretary Folger took the matter under consideration. The companies hope to secure the privilege of putting their lights in all the public buildings as a substitute for gas.

ALLEGHENY, PA.—Bids for lighting the city buildings were opened on Sept. 7. The Thomson-Houston Electric Light Company, whose bid was $4,500, and the Cutter Electric Light Company, whose bid with one kind of engine was $5,300 and another $5,000, being unaccompanied by bonds, were excluded, and the bid of the Brush Electric Light Company for $4,950 was recommended to Councils.

MEADVILLE, PA.—At the meeting of the City Council on the 5th inst. Mr. Boynton, of the Committee on Electric Light, reported a number of additional applications from electric light companies (Fuller Electrical Company, of New York; C. W. W. Ball & Co., of New York; Arnoux Electric Light and Heat Company, of Pottsville, Pa.) for the privilege of submitting propositions. He said he had answered all, requesting proposals.

ELECTRIC LIGHT COMPANIES AT LAW.—A dispatch from Washington, dated the 10th, says: The Consolidated Electric Light Company, of New York, to-day filed a bill against the United States Electric Light Company, of Washington, for an injunction. The complainant claims to be the sole owner of the original letters patent for an electric lighting system obtained by W. E. Sawyer and Albion Mann in 1878, and it charges that the defendant is now making and selling the patented invention of the electric light system, and is also infringing upon other patents.

LIGHT IN CABS.—A correspondent writing of the Vienna Electrical Exhibition says: "Even the cabmen here have become enamored of electricity. Leopold Frank, No. 737, is the first cabman who has introduced electric lighting into this useful class of vehicle. The municipal authorities found no reference to anything but oil lamps and tallow candles in the cab rules, and made some difficulties at first about authorizing this worthy enterprise, but a noble persistence has overcome all difficulties. Frank has got the sanction of the chief magistrate, and no doubt is now charging quadruple fares for rides in his scientific cab."

A NEW COMPANY IN BOSTON.—The Merchants' Electric Light and Power Company has been organized in Boston with a capital of $300,000. William A. Hovey is President; William W. Gooch, Secretary; H. E. Irvine, Treasurer; M. Lee Ross, General Manager; and P. A. Dowd, Superintendent. The company has purchased from the American Electric and Illuminating Company its electric-lighting plant and business in Boston, the latter company having become exclusively a construction company.

THE LIGHT ON SHIPBOARD.—The largest shipping contract for electric lighting up to the present time has been concluded in Glasgow, says the *Pall Mall Gazette*, between the owners of the New Zealand Shipping Company's fleet and the Edison Company's branch in Scotland, under the management of Mr. Charles T. Grant. Three fine steamers, two of which are sister ships to the steamship Tongariro, launched at Messrs. John Elder & Co.'s yard, are to be lighted throughout with the incandescent light and fitted with a duplicate set of Edison's marine dynamos and engines, one set being for reserve in case of emergency.

RACES BY ELECTRIC LIGHT.—A dispatch from Lewiston, Me., says that, additional to the contract made by the trustees of the Maine State Agricultural Society with the American Electric Light Company for lighting the hall and horse and cattle departments at the State Fair grounds, a contract was made, Sept. 10, by President Prince and Treasurer Osgood with D. W. Coolidge, of Portland, manager of the Consolidated Electric Light Company of Maine, to light the track on the grounds Wednesday evening, Sept. 19. Arrangements are being made

with the leading horsemen of the State for races by electric light on that evening.

THE AMERICAN ELECTRIC AND ILLUMINATING COMPANY.—This company reports 550 lights in use in Boston. The apparatus in use in Cottage City is to be transferred to Boston. The Lowell *Mail* says the Middlesex Company of that city, which uses the Thomson-Houston dynamos of the American Company, has four dynamos in operation, running 25 lights each, and expects to have four more in a day or two, increasing the capacity to 200 lights, which will again be increased in a short time to 16 dynamos or 400 lights. The present single engine of 125 horse-power will be re-enforced by another cylinder, doubling its power. The business of the company is rapidly growing, and there were 25 applications for new lights one day last week.

ELECTRIC LIGHT PURCHASE IN MAINE.—A telegram, dated Portland, Me., Sept. 7, says that negotiations have been concluded for the purchase by the American Electric and Illuminating Company, of Boston, of the entire business, franchises and contracts of the Arnoux Electric Lighting Company in Maine, including the central station in Portland, with its engines, boilers, lines of poles, wire, structures, etc., which are quite extensive. The American company obtained a charter some weeks ago for a new corporation in Maine, under the name of the Consolidated Electric Light Company, of Maine, which it controls. Under this charter the entire business in this State will be conducted. A 200-light station is to be put in Portland, and a 100-light station in Saco and Biddeford. Central stations are also to be constructed for Lewiston, Bath, Augusta and Bangor, besides in many of the smaller towns. The 100-light station at Old Orchard will be transferred to the new company.

THE CHANGE IN LOWELL.—The new electric lighting station of the Middlesex Company in Lowell, recently purchased from the Weston Company, was formally opened and inspected on Wednesday evening. The plant is now being operated with four Thomson-Houston dynamos and four Weston light dynamos. The latter will be taken out as soon as the Thomson-Houston machines arrive to take their places. Eventually, there will be in use 16 of the last-named dynamos, of a capacity of 25 lights each. The present single engine of 125 horse-power will soon be made a double engine, and two small engines of 50 horse-power, each of which were used at the old station, will be brought into requisition. They will be placed on the second floor, to be used exclusively in running the city all night lights. At present the company is running 130 lights, but has orders on hand for enough to bring the total to 220. By the first of October it expects to have 250 lights burning and 300 by New Year. The Middlesex has made remarkable progress. Its first lights were started March 17th last, and now it is the only company in Lowell. The Lowell *Courier* says the company provides a thoroughly satisfactory light and that it was bound to win on its merits. The managers have worked hard, but they have the satisfaction of knowing that the results have justified their labors.

MISCELLANEOUS NOTES.

UNDERGROUND WIRES IN FRANCE.—Marseilles and Paris are now connected, at a cost of $8,000,000, with an underground cable, which is laid in a cast-iron pipe six feet below the surface, and so arranged that it can be from time to time inspected.

INCORPORATED.—The certificate of incorporation of the Automatic Lightning Arrester Co. was filed in the County Clerk's Office, this city, Sept. 13. The certificate of incorporation of the Underground Conduit and Pneumatic Delivery Company was also filed the same day.

ELECTRICITY IN DENTISTRY.—A new application of electrical apparatus has been made to dentistry. This week a man at Taunton, Mass., was caught by a loose, dragging, telegraph wire in such a manner that two of his teeth came out. Persons of scant means and troubled with toothache can take the hint. Truly this is an age of novel scientific applications.

ACCIDENT ON AN ELECTRIC RAILWAY.—Not to be outdone by its elder brother, the electric railway has already had a fatal accident, not, however, owing to any electrical cause. The *Pall Mall Gazette* reports that a man employed on the Portrush & Giant's Causeway Electric Railway, while attempting to leap into a wagon in motion, missed his footing and fell underneath the train. Death was instantaneous.

EARNINGS OF ELECTRICAL CORPORATIONS.—Among the corporations which have recently reported to the Comptroller of this State their gross earnings for the year, on which a tax of one-half of one per cent. is imposed, are the following:

People's Telephone	$1,868
Law Telegraph Company	113,270
Gold and Stock Telegraph	886,249
Commercial Telephone	90,585
Metropolitan Telephone	595,676

UNDERGROUND WIRES.—The following order has been issued by the District Commissioners of Washington: "Ordered, that the engineer commissioner be requested to report what alley routes may be substituted for the present street telephone lines, and whether the number of lines already running through the city could without detriment to the service be materially diminished. Also to report a plan for causing the telegraph lines to be put under ground within the limits of the city." The Commissioners have refused to allow the companies to build new lines of poles or to reset old.

A NEW EXCHANGE.—A new exchange is to be incorporated in this city to deal in all securities not listed at the Stock Exchange, especially electric light, telegraph, telephone, electric signal, manufacturing, insurance, bank, gas, street-car, railroad and other stocks. Several banks, including the Chatham National, the St. Nicholas and the Third National have interested themselves in the enterprise, and a number of members of the Stock Exchange have purchased seats. The capital stock will be $62,500. The membership will be limited to 500. Seats can now be purchased for $125 each. The name will be "The Electric Manufacturing and Miscellaneous Exchange."

THE ELECTRIC RAILWAY IN ENGLAND.—The electric railway constructed on the beach at Brighton, England, by Mr. Magnus Volk, the corporation electrical engineer, has been opened. The line is about a quarter of a mile in length, and runs along the beach from the entrance to the aquarium to the Chain pier. The road is 24-inch gauge, and the rails are laid on longitudinal sleepers. The driving machinery consists of a Crossley two-horse-power engine and a Siemens D 5 dynamo. The current is conveyed to one of the rails, and passes from thence through the wheels of the car to the motor. Ten persons, in addition to the driver, can be carried at a rate of about six miles an hour on the level.

EDISON'S ELECTRIC RAILROAD.—About fifty prominent railroad men and electricians visited Menlo Park, N. J., on Tuesday last to witness the operation of the electric railroad. Mr. C. W. Rogers, Vice-President of the Electric Railway Company of the United States, took the party in charge. They were shown the stationary engine affording the motive power, and then, taking seats in a car, made a successful trip around the track, a stretch of two miles and a half. In reply to the favorable comments of the railroad men, Mr. Rogers said that he hoped to show them the system much more complete in two months—the system as the company desired to use it. The engine would then pick up the current from a third rail, laid between the others.

NEW SIGNALS AND SWITCHES.—Last week the entire system of signals and switches used in the yard in the rear of the Grand Central station in New York and along the line of tracks through the Vanderbilt tunnel was changed. Up to that time the switches and signals had been set and changed by hand, about 40 men being employed at that work in the yard between Forty-fifth and Forty-ninth streets alone. Now the entire work is done automatically by means of what is known as the interlocking switch and signal apparatus. The machinery used is what is known as the Saxby and Farmer system, combining with the Sykes system of electric locks. The new system is expected to be especially valuable from the manner in which all the trains are run into the Grand Central station by what is known as a "flying switch."

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted on Thursday of last week and Thursday of this week as follows:

	Sept. 6.	Sept. 13.
American Cable	64¾	64¾
Western Union Telegraph	81	82⅛
Bankers' and Merchants' Tel.	129	131¼
Mutual Union Telegraph	[illegible]	7⅞
American District Telegraph	30	25
Bay State Telephone	99	....
Bell Telephone	....	230
Mexican Telephone Co.	2¼	2⅜
National Bell Telephone of Maine	70	75
Suburban Telephone Co.	105	107½
New York and Pennsylvania	92	91
Boston & Northern Telephone	125	117½
Erie Telephone	60	59
People's Telephone	....	8½
People's Telephone (New England)	5	....
New York and New Jersey	96	95

EFFECT OF ELECTRICITY ON NERVES AND HEART.—Among the curious exhibits at the Munich Electrical Exhibition were a series of photographs representing the various changes and contortions produced in the human face by subjecting the different facial nerves of a patient to the action of electricity. These were the experimental photographs by Prof. Von Ziemssen. The expressions of joy, pain, surprise, doubt, disgust, etc., were easily realized, according to the nerve that was touched by the electrode. Other observations and experiments by Prof. Von Ziemssen promise to be of great importance. They institute a comparison between the continuous and the induced current in the stimulation of the important accelerator and depresser nerves which control the heart. He has found that an induced current, so far from stimulating the nerves of the heart, as heretofore believed, is perfectly inoperative, whereas a continuous current from an ordinary battery is of the very greatest activity.

ELECTRIC TRAM CAR IN PARIS.—The propulsion of tram cars by electricity was satisfactorily tested by the French Electrical Power Company on the 6th inst. The vehicle used was an ordinary three-horse tram car, and it was propelled through the important thoroughfares for a distance of thirty miles. The trial lasted six hours, and, it is said, was not attended by any accident or the frightening of horses. The driver seems to have had no difficulty in bringing the car to a stand-still within a second whenever he desired. The vehicle was turned off from one set of tracks to another across several yards of trackless ground with admirable ease. The locomotion is effected by Faure-Sellon-Volckmar accumulators. The speed was nine and one-third miles an hour on level ground and five and one-half miles on an ascent. This experiment, the first ever made over a long distance, is regarded as proving the practicability of electric tram cars. The estimated cost is one-half that of horse trams. M. Ferdinand de Lesseps and several engineers and journalists witnessed the trial.

AN ELECTRICAL CAR.—A St. Louis inventor is building an electrical car, which is thus described by the *Republican* of that city. "There is our motive power," said the doctor, drawing attention to a medium-size narrow-gauge railway-coach wheel. Sections of the cavity of the wheel were filled solid with wire, making a weight of 700 pounds, or about 100 pounds more than an ordinary wheel. On the same axle to which the wheel is attached there is another contrivance which is driven in one direction by the brushes, and that in turn revolves the main wheels in an opposite course. Each of the track wheels under a coach, the doctor claims, can be made to produce from one to four horse-power, and attain a speed as high as eighty miles an hour. The power current is obtained from a copper tube with a narrow slot extending its entire length, from one end of the track to the other. Within the tube there is an easy fitting coil of brass plug that is arranged to slide along with the motion of the car, supplying the wire conductor with the necessary current to be applied direct to the driving-wheels. A model elevated railway car fitted with these appliances was next looked at. It is elegant in design and symmetrical in proportion. At the forward end there is a sort of vestibule, which the passengers enter and alight from, on one side of the coach, immediately under the eye of the conductor, who is also the engineer, who governs the motion by simply moving a polished brass lever to the right or left. "We carry no dead weight by this system," continued the doctor. "Our wheels won't slip for want of traction to the rails. The weight of every additional passenger fully supplies that want in proportion to the additional power to carry him."

ELECTRICAL PATENTS ISSUED

And Dated Sept. 4, 1883.

CRIPPLING THE PATENT OFFICE.—On July 1 the number of clerks in the Patent Office was reduced by twenty-five, in accordance with the requirements of the last Congress. Commissioner Marble says that this reduction will necessarily cripple the efficiency of this office to a considerable extent, and it will probably compel inventors to suffer additional delay in many cases. The Patent Office is much more than self-sustaining, but the salaries paid to examiners are not large enough to tempt them to remain in the government service any longer time than is necessary for them to become qualified to engage in business for themselves as patent agents and attorneys. Since Jan. 1 three principal examiners and eight assistant examiners have resigned to engage in private practice. The whole corps of examiners changes about once in five years, and in the electrical class it is said the examiners average less than two years' service each.—*Industrial News.*

The above note may explain the delay occasioned in the mailing of the *Official Gazette* and in getting other matter ordered from the Patent Office. The material to enable us to illustrate the inventions we desired for this week was not received until Wednesday noon. This did not give us time enough to make plates of the drawings, and consequently we are obliged to omit the illustrations from this issue. We have written to the Commissioner of Patents on the subject and sincerely hope that in future he may be able to prevent such apparently altogether unreasonable delays in his mailing department.

Apparatus for filling cables with insulating substances: William R. Patterson, Chicago, Ill. 284,226
Automatic circuit closer for telegraph keys; Samuel J. Spurgeon, Liberty, Mo. 284,508
Circuit and apparatus for electrical temperature and and pressure indicators; Charles L. Clarke, New York, N. Y. 284,382
Circuit for secondary electric clocks; Henry L. Bailey, Brooklyn, N. Y. 284,355
Compound electric conductor; William B. Hollingshead, New York, N. Y. 384,423
Dynamo-electric machine; Charles E. Ball, Philadelphia, Pa. 284,357
Dynamo-electric machine; William B. Cleveland, Cleveland, O. 284,277
Dynamo-electric machine; William B. F. Elphinstone, Musselburgh, Scotland, and Charles W. Vincent, Holloway, England 284,288
Dynamo-electric machine; James E. H. Gordon, Kensington, County of Middlesex, England 284,292
Electric arc lamp; Robert J. Sheehy, New York, N. Y. 284,497
Electric call and signal; LeRoy S. White, Waterbury, Conn. 284,348
Electric lighting; Killingworth W. Hedges, Westminster, County of Middlesex, England 284,420
Electric motor; Levi W. Stockwell, Cleveland, O. 284,255
Electric spark arresting circuit and device; Henry L. Bailey, Brooklyn, N. Y. 284,354
Electro-magnetic car wheel and brake; Henry M. Beidler, Texarkana, Ark. 284,365
Electro-magnetic rheotome; Frank L. Pope, Elizabeth, N. J. 284,480
Flexible electrical conductor; Henry B. Lytle, Boston, Mass. 284,216
Incandescent electric lamp; Tom Ernest Gatehouse, Camberwell, County of Surrey, England 284,409
Preparation or production of insulating materials or articles; John Ambrose Fleming, Hempstead, England 284,289
Primary electric clock; D. Fred Sweet, Hastings, Mich. 284,578
Secondary battery; Alfred Pribe, Denbigh Road, County of Middlesex, England 284,343
Secondary or storage battery; Eli T. Starr and E. Eugene Starr, Philadelphia, Pa. 284,577
Storage battery; Cornelius T. Tomkins, New York, N. Y. 284,342
Switch-board for electric light stations; Robert J. Sheehy, New York, N. Y. 284,247
Telegraph blank; Newton W. Hartwell, Louisville, Ky. 284,297
Telegraphic apparatus; Frank L. Pope, Elizabeth, N. J. 284,481
Telegraphy; Gerritt Smith, Astoria, and Theodore F. Taylor, Brooklyn, N. Y. 284,498

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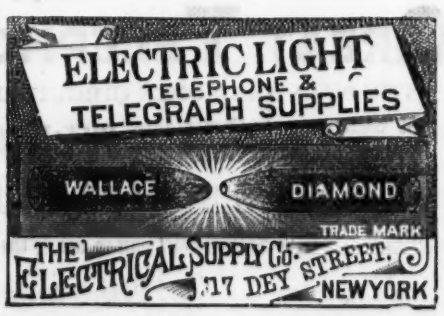

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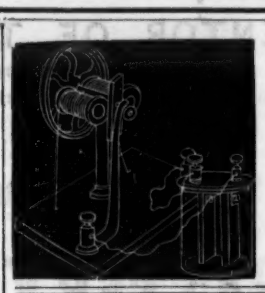

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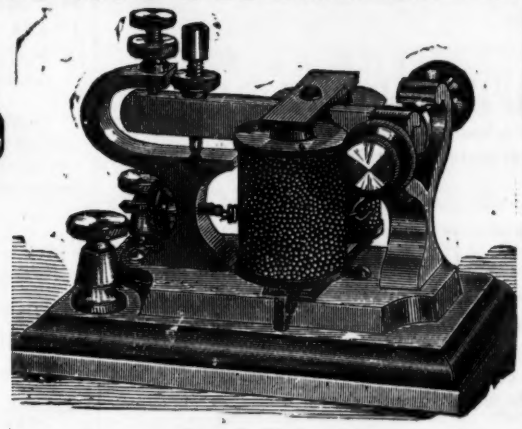

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PRACTICAL INFORMATION FOR TELEPHONISTS. By T. D. LOCKWOOD, Electrician, American Bell Telephone Company. 12mo, cloth. New York, 1882. $1.00.

CONTENTS.

Historical Sketch of Electricity from 600 B. C. to 1882 A. D.—Facts and Figures about the Speaking Telephone—How to Build a Short Telegraph or Telephone Line—The Earth and its Relation to Telephonic Systems of Communication—The Magneto-Telephone; What it is, How it is made, and How it should be handled—The Blake Transmitter—Disturbances Experienced on Telephone Lines—The Telephone Switch-Board—A Chronological Sketch of the Magneto-Bell, and How to Become Acquainted with it—Telephone Transmitter Batteries—Lightning; its Action upon Telephone Apparatus; How to prevent or reduce Troubles Arising therefrom—The Telephone Inspector—The Telephone Inspector; his Daily Work—The Inspector on Detective Duty—The Daily Routine of the Telephone Inspector—Individual Calls for Telephone Lines—Telephone Wires *versus* Electric Light Wires—Electric Bell Construction—Housetop Lines, Pole Lines and Aërial Cables—Anticipations of Great Discoveries and Inventions.

The chapters of which this book is composed were originally published in THE OPERATOR, where they were found so useful to practical telephone men as to induce an imperative demand for their re-publication in the present convenient form. The book, while giving a mass of valuable information, such as could only be acquired by an extended practical experience with the telephone, is written in an easy, chatty style, which makes it entertaining reading. It is the only book that contains a description of the Blake transmitter, now used almost universally throughout the United States. No one who has anything to do with telephones can fail to find in it something of interest or value; but it is particularly useful to the managers and employés of telephone exchanges, as it gives them valuable instruction about every detail of their work.

THE TELEPHONE. An Account of the Phenomena of Electricity, Magnetism and Sound, as Involved in its Action; with Directions for Making a Speaking Telephone. By A. E. DOLBEAR. Second Edition. 18mo, cloth, 17 illustrations. Boston, 1883. 50c.

CONTENTS.

Electricity—Magnets—The Galvanic Battery—Other Means for Generating Electricity—What is Electricity?—Sound—Correlation—Reiss, Gray, Bell and Dolbear Telephones—How to Make a Telephone.

A very interesting little volume, which clearly explains the fundamental principles of the telephone in an able manner. The first edition had a large sale, and the demand for the book still continuing, a second edition has just been issued at a reduced price.

THE TELEPHONE. A Lecture by PROF. ALEXANDER GRAHAM BELL, Delivered before the Society of Telegraph Engineers. 8vo, paper, 30 illustrations. London, 1870. 60c.

This is a complete and concise account of the stages of experimentation gone through by Professor A. Graham Bell, before his researches resulted in one of the greatest triumphs of modern science. All who believe Bell to be the original inventor of the speaking telephone should have a copy of the work from which to quote. All who believe that he was not, should have one, so as to acquaint themselves with what can be advanced in support of the claims made for Bell. In fact, everybody interested in telephony should read it.

THE TELEPHONE, THE MICROPHONE, AND THE PHONOGRAPH. By COUNT DU MONCEL. Authorized Translation, with Additions and Corrections by the Author. 12mo, cloth, 70 illustrations. $1.25.

CONTENTS.

History of the Telephone—Musical Telephones—Speaking Telephones—Fundamental Principles of Bell Telephone—Battery Telephones—Modification of Bell Telephones—Experiments with the Telephone—Other Experiments with the Telephone—The Microphone—Applications of the Microphone—External Influence on Telephonic Transmissions—Establishment of Telephone Station—Call-Bells and Alarums—Applications of the Telephone—Various Uses of the Telephone—The Phonograph—Uses of the Phonograph—Faber's Speaking Machine—Appendix.

Count Du Moncel's is one of the cheapest books in the market. In his accustomed easy and popular style the author discusses the speaking telephone. Beginning with the Reiss telephone, and giving due place to the musical telephones of Wray, Pollard and Garnier and Varley, and the well-known string telephone, or lovers' telegraph, the magneto telephone of Bell is reached and fully described. After this the respective claims of Gray and Bell are impartially canvassed. The Bell telephone, with its thousand and one modifications, the battery telephone and microphone, with the adaptations of both to oral communication, pass before the reader in turn. A chapter is devoted to disturbances which appear on telephone wires, and another to the phonograph. Those who can only afford one book on the telephone, should make a point of securing this one.

THE SPEAKING TELEPHONE, ELECTRIC LIGHT, AND OTHER RECENT ELECTRICAL INVENTIONS. By GEORGE B. PRESCOTT. 8vo, cloth, 319 illustrations and 1 plate. New York, 1879. $4.00.

CONTENTS.

The Speaking Telephone—Bell's Telephonic Researches—The Telephone Abroad—History of the Production of Galvanic Music—Gray's Telephonic Researches—Edison's Telephonic Researches—Electro-Harmonic Telegraphy—Dolbear's Telephonic Researches—Improvements of Channing, Blake and others—The Talking Phonograph—Quadruplex Telegraphy—Electric Call Bells—The Electric Light—Edison's Recent Telephonic and Acoustic Inventions—Duplex Telegraphs, Electro-Magnets and Electric Time Service.

This is a large and handsome work, the object of which is to furnish the public with a clear and accurate description of the more recent and useful improvements in electrical science, and especially to explain the principles of that marvelous production, the speaking telephone. The most interesting portion of the work, to most readers, is the history of the original telephonic researches of Bell, Gray and Edison, the account of each inventor's experiments being given in his own words. It contains also a very thorough description and explanation of the quadruplex telegraph, with numerous diagrams, showing how the wires are arranged, and gives excellent accounts of the Brush, Maxim, Jablochkoff, Thomson-Houston, and other systems of electric arc lighting, with descriptions of the dynamos, etc. The illustrations throughout the work are very fine.

ELECTRIC LIGHTING.

ELECTRIC LIGHT, ITS PRODUCTION AND ITS USE; EMBODYING PLAIN DIRECTIONS FOR THE WORKING OF GALVANIC BATTERIES, ELECTRIC LAMPS AND DYNAMO-ELECTRIC MACHINES. By J. W. URQUHART, C.E. Edited by F. C. WEBB, M.I.C.E., etc. 8vo, cloth, 94 illustrations. London, 1880. $3.00.

CONTENTS.

Introduction—Voltaic Batteries—Thermo-Electric Batteries—Magneto-Electric Generators—Electro-Magnetic Electric Machines—Dynamo-Electric Machines—General Observations on Machines—Electric Lamps and Candles—Measurement of Electric Light—Mathematical and Experimental Treatment of the Subject—Application and Cost of the Electric Light.

A very convenient and complete treatise on the electric light. The principles are defined in a manner devoid of technicalities, so as to render the book very valuable to the beginner. The history of the dynamo-electric machine and its development, from the Pixii to the Gramme machine, is also quite complete. The recent types of machine receive a full share of attention and the various styles of lamps are treated in full.

ELECTRIC LIGHTING. Translated from the French of LE COMTE TH. DU MONCEL, by ROBERT ROUTLEDGE, B.Sc. Crown 8vo, cloth, 76 illustrations. London, 1882. $1.25.

CONTENTS.

General Considerations—Generators of Electric Light—Electric Lamps—Cost of Electric Lighting—Applications of Electric Light—Conclusion—Notes and Appendices.

A translation of the work of this prolific writer on electrical subjects, published at Paris, in 1880, under the title of "L'Eclairage Electrique," to which the translator has added brief accounts of the apparatus connected with electric lighting which have been brought forth since the publication of the original edition, viz., Swan's, Maxim's, Edison's, and Fox-Lane's incandescent lamps, and the Faure secondary battery. To the student or the general reader who desires information free from abstruse technicalities, and at an insignificant cost, on a subject that is attracting general attention, this work, the original of which is one of a popular science series, can be recommended. The object held constantly in view by the author was to make the treatise thoroughly practical. The book is the cheapest one that aims to cover the whole ground of electric lighting.

ELECTRIC LIGHTING AND ITS PRACTICAL APPLICATION; WITH RESULTS FROM EXISTING EXAMPLES. By J. N. SHOOLBRED. 8vo, cloth, 5 plates. London, 1879. $2.00.

CONTENTS.

Historical and Descriptive—Electric Light Machines—Lamps and Regulators—Carbons; Conducting Wires—Motive Power—Luminous Intensity—Applications; Economic Results—Prospects of Electric Lighting.

A handy little treatise, very valuable to the beginner. The author adopts a popular method of treating the subject and avoids technicalities as much as is compatible with the precision of the work. The history of the early efforts in this field is given, the apparatus being briefly described in each case. The notice of recent inventions, up to the date of print, is quite complete. The questions of power and of photometry form the subjects of very interesting and instructive details.

USEFUL INFORMATION ON ELECTRIC LIGHTING. By KILLINGWORTH HEDGES, M.S.T.E. Fourth Edition, Revised and Enlarged. Crown 8vo, cloth, 20 plates. London, 1883. $1.75.

CONTENTS.

Production of Electricity—Voltaic Arc—Division of the Electric Light—Machines or Generators—Power required and Motors—Application of the Electric Light—Choice of a System—Setting to Work—Cost of Working—Measurement of Light and Current—Storage of Electricity and Transmission of Power—Electrical Measurement of Work—Useful Memoranda.

The first edition of this work met with so great a success as to encourage the issue of enlarged second and third editions, which have in turn been exhausted. A fourth edition, still further enlarged, has just been issued.

ELECTRIC LIGHTING BY INCANDESCENCE, AND ITS APPLICATION TO INTERIOR ILLUMINATION. A Practical Treatise. By WILLIAM E. SAWYER. 8vo, cloth, 96 illustrations. New York, 1881. $2.50.

CONTENTS.

Introduction—Generators of Electricity—Generators of the Gramme Type—Generators of the new Siemens Type—Incandescent Lamps—Carbons for Incandescent Lighting—New Forms of Lamps—Preservation of Incandescent Carbons—Division of Current and Light—Regulators and Switches—General Distribution—Commercial Aspects.

This book is an indispensable addition to the libraries of all who desire to keep up to the age in the novelty of electric lighting. Its author neglects the arc light altogether, and gives his readers a graphic account of the generators employed in the production of the necessary currents; of those lamps which utilize the currents when generated; of the most advantageous circuit arrangements and apparatus, and of the best materials to use in lighting by incandescence. A historical sketch shows that the idea of electric lighting by incandescence is as old almost as telegraphy itself. The book is handsomely printed and copiously illustrated.

INCANDESCENT ELECTRIC LIGHTS, WITH PARTICULAR REFERENCE TO THE EDISON LAMPS AT THE PARIS EXHIBITION. To which is added The Economy of the Electric Light by Incandescence, by JOHN W. HOWELL; and On the Steadiness of the Electric Current, by C. W. SIEMENS. Illustrated. 18mo, boards. New York, 1882. 50c.

There is no book that contains more valuable information in the same space than this. On the question of incandescent lights it must be considered the best authority at present accessible. The tables and data given help very much in analyzing facts and making comparisons. The article by Mr. C. W. Siemens is especially valuable and interesting. It refers to a new method of exciting the field of dynamo-electric machines, which enables the current to maintain itself constant in the external circuit, no matter how great and rapid the variations of resistance may be. This method has come into use as a most valuable adjunct in the dynamos intended for incandescent lamps, where it enables any of the lamps to be put on and off at will without affecting the rest. For this reason this article is of great interest to every person interested in electric lighting.

VARIOUS APPLICATIONS.

ELECTRO-MOTORS. A Treatise on the Means and Apparatus employed in the Transmission of Electrical Energy and its conversion into Motive Power. By J. W. URQUHART. 12mo, cloth, illustrated. London, 1882. $3.00.

CONTENTS.

Introduction—On the Dynamical Nature of Electric Currents—Electrical Measurements—Electro-Magnetic Force—Electro-Magnets and Armatures—Electric Accumulators or Magazines—The Construction and Efficiency of Electro-Motive Machines—Electric Railways—Minor Applications of Electro-Motive Energy—Fragmentary Information.

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ELECTRIC TRANSMISSION OF POWER; ITS PRESENT POSITION AND ADVANTAGES. By PAGET HIGGS, LL.D., D.Sc. Crown 8vo, cloth, 21 illustrations. London, 1879. $1.20

CONTENTS.

Dynamo-Electric Machines—The Gramme Machine—The Brush Machine—The Wallace-Farmer and Siemens' Machines—Efficiency of Dynamo-Electric Machines—Practicability of Transmission of Power by Electricity—Efficiency of Coupled Machines—Comparative Efficiency of Various Machines—Other Theoretical Considerations—Conclusions.

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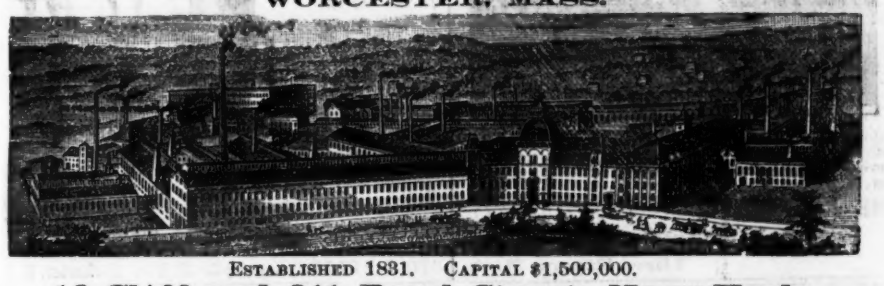

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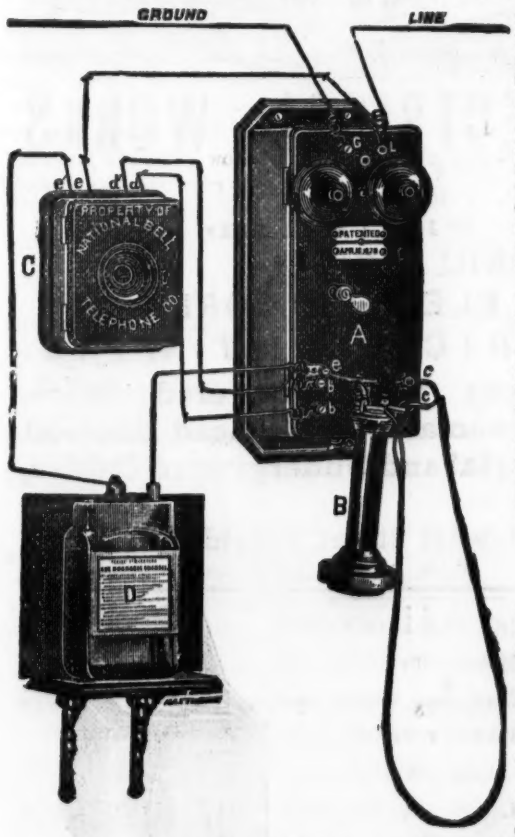

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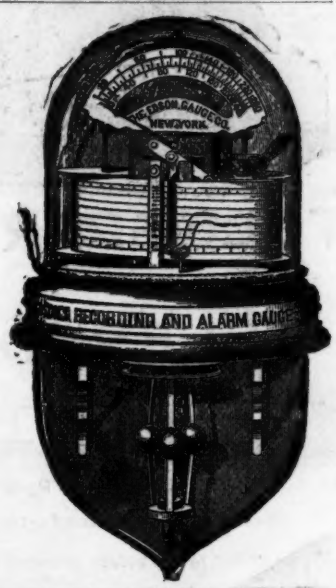

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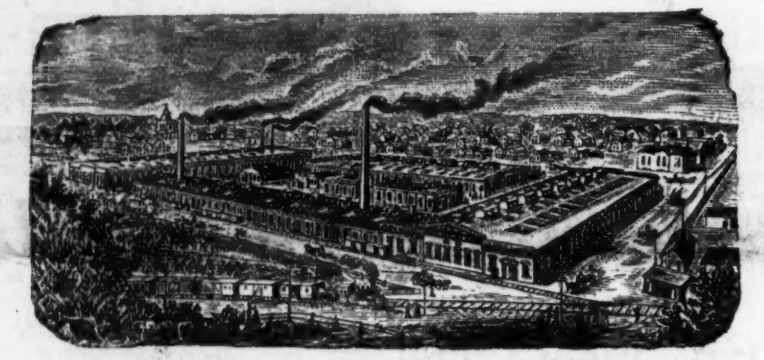

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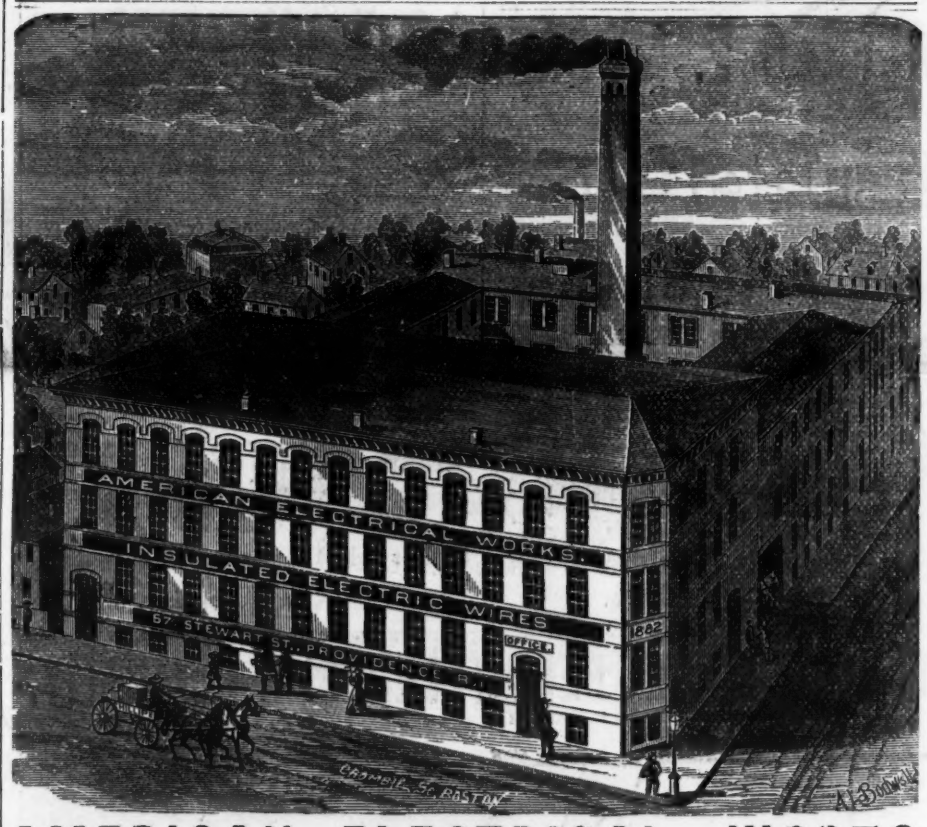

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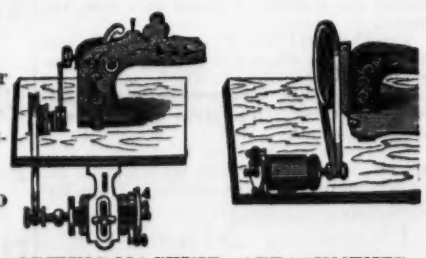

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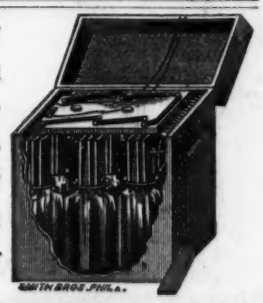

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